DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
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5090
Ser 5CEN.MB/621
October 2, 2003

Ms. Beatrice Griffey
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Region IX, Code SFD-8-B
75 Hawthorne Street
San Francisco, CA 94105-3901

Dear Ms. Griffey, Mr. Mahmoud, and Mr. Hausladen:

The Department of the Navy forwarded the document "Draft Final Remedial Action Site Closure Report" for Installation Restoration Site 1F at Marine Corps Base, Camp Pendleton to the Federal Facilities Agreement (FFA) team members over 30 days ago. No additional comments were received during this time period. Per FFA section 7.9, Finalization of Documents, the Draft Final primary document is now Final.

Please place a copy of this letter in the front cover of the document. Should you have any questions, please call the Department of the Navy Remedial Project Manager, Mr. Mike Bilodeau, at (619) 532-3829.

Sincerely,

Kathie Beverly

KATHIE BEVERLY
Environmental Business Line
Team Leader
By direction of the Commander

5090
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October 2, 2003

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DRAFT FINAL REMEDIAL ACTION SITE CLOSURE REPORT
OPERABLE UNIT 3, INSTALLATION RESTORATION SITE 1F
43 AREA REFUSE BURNING GROUND
CAMP PENDLETON, CALIFORNIA

Environmental Remedial Action
Contract No. N62474-98-D-2076
Contract Task Order 0080

Document Control Number 6472
Revision 0

August 6, 2003

Submitted to:

U.S. Department of the Navy
Southwest Division
Naval Facilities Engineering Command
1220 Pacific Highway
San Diego, California 92132-5190

Submitted by:

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Prepared by:

for _____ Date: 8-6-2003
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Approved by:

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T. Max Pan, P.E.
Senior Project Manager

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Abbreviations and Acronyms

ARAR	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
Cal/EPA	California Environmental Protection Agency
CalTrans	California Department of Transportation
CAMU	corrective action management unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
COEC	chemical of ecological concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CQC	contractor quality control
CTO	Contract Task Order
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DLM	designated level methodology
DON	U.S. Department of the Navy
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EcoRA	ecological risk assessment
ECP	environmental control plan
EDXRF	energy dispersive x-ray fluorescence
FFA	Federal Facility Agreement
HHRA	human health risk assessment
HQ	hazard quotient
IR	Installation Restoration
IRP	Installation Restoration Program
IT	IT Corporation
MCB	Marine Corps Base
mg/kg	milligrams per kilogram
msl	mean sea level
NAD	North American Datum
NOI	Notice of Intent
OU3	Operable Unit 3
PA/SI	preliminary assessment/site inspection
PED	planned excavation depth
PLE	preliminary limit of exposure
PRG	preliminary remediation goal
QC	quality control
RA	remedial action

Abbreviations and Acronyms (Cont.)

RD	remedial design
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RWQCB	California Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act of 1986
SWDIV	Southwest Division Naval Facilities Engineering Command
SWPPP	storm-water pollution prevention plan
UCL	upper confidence limit
UCL_{95}	95 percent upper confidence limit
U.S. EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
yd^3	cubic yards

Executive Summary

A remedial action was implemented pursuant to the Record of Decision (ROD) for Operable Unit (OU) 3 (OU3 ROD) dated January 11, 1999 (SWDIV, 1999a), for the remediation of soil contamination at Installation Restoration (IR) Site 1F at Marine Corps Base (MCB) Camp Pendleton (base) in San Diego County, California.

IR Site 1F was a former refuse burning ground. The site was used by the base between 1942 and the early 1970s to burn refuse generated by base operations. IR Site 1F was designated under the MCB Installation Restoration Program (IRP) as a Group D site for conducting the remedial investigation and feasibility study (RI/FS) pursuant to the process mandated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The conclusions from the RI work performed for Group D sites and the RI/FS work for OU3 sites indicated that soil at IR Site 1F was impacted by past disposal activities and could pose a risk to surrounding environmental receptors and human health. As a result, remedial action was required for the protection of human health and the environment.

Based on the OU3 ROD, remedial actions taken at IR Site 1F shall include the following:

- Excavation of contaminated soil; the maximum excavation depths were 5 feet for ecological concerns and 10 feet for human health concerns.
- Confirmation sampling of the bottom and sidewalls of the excavation in accordance with *Methods for Evaluating the Attainment of Cleanup Standards, Volume I: Soils and Media*, PB89-234959, prepared by the U.S. Environmental Protection Agency (U.S. EPA).
- Transportation to and disposal of soil meeting technical and legal requirements (i.e., specified in Title 40, Code of Federal Regulations (CFR), Section 264.552[c]) at an on-base landfill, IR Site 7 (Box Canyon landfill), a designated corrective action management unit (CAMU).
- Backfilling of the excavation with clean soil upon confirmation that cleanup standards were met; if standards were not met at the maximum excavation depths (i.e., 5 feet for ecological concerns and 10 feet for human health concerns), placing 5 or 10 feet of clean fill, as relevant.
- Site regrading and revegetating.

A site-specific remedial design and remedial action (RD/RA) work plan was developed to meet the OU3 ROD requirements. The RD/RA work plan provides details on the RA process, site preparation, remedial excavation, waste transportation and disposal, cleanup confirmation

criteria and methodology, and final site restoration approach. The final remedial action for IR Site 1F was implemented in accordance with the RD/RA work plan in 1999 (excavation and disposal) and 2000 (final site restoration).

This report was prepared to document the RA details in accordance with U.S. EPA guidance for preparing final RA reports. The report provides an overview of the site-specific background and the decisions pertinent to the development of the final RA, chronology of the RA and construction activities, evaluation of the performance standards and construction quality control, site inspection and certification, post-RA operation and maintenance, and summary of project costs.

The report is supported by five appendices that provide documents on the preconstruction biological survey, photographs of construction activities, backfill contractor quality control, site revegetation seed mix, and analytical data summary and documentation.

In summary, the RA at IR Site 1F was conducted in accordance with the approved RD/RA work plan. The total volume of soil removed was approximately 55,250 cubic yards (originally estimated at 32,488 cubic yards) between June and September 1999. The excavated soil from IR Site 1F was transported to and disposed of at a CAMU located at IR Site 7. The cleanup efforts were evaluated in accordance with the RD/RA work plan and found to meet the OU3 ROD requirements and cleanup standards. The excavated site was approved for final backfill and was restored with native vegetation during October 2000. The total cost for conducting the final RA was approximately $1.588 million (originally estimated at $1.5 million) in 1999/2000 dollars.

IR Site 1F is considered a clean closure because the residual contamination poses no unacceptable exposure risk to human health or the environment. As such, 5-year reviews, further remedial action, and/or post-RA monitoring and maintenance are not required.

1.0 Introduction

This report was prepared by Shaw Environmental, Inc. (formerly IT Corporation) in partial fulfillment of work scope of Contract Task Order (CTO) No. 0080 issued under Southwest Division Naval Facilities Engineering Command (SWDIV) Remedial Action Contract No. N62474-98-D-2076. This report summarizes the remedial action activities implemented by Shaw Environmental, Inc. at Installation Restoration (IR) Site 1F, 43 Area refuse burning ground, located at Marine Corps Base (MCB) Camp Pendleton in San Diego County, California.

This report will reflect the use of IT Corporation (IT) as the preparer of the report because the activities described in this report were performed by IT before Shaw Environmental, Inc. acquired IT in May 2002.

1.1 Project Background

MCB Camp Pendleton (base) is the primary amphibious training center for the west coast. Located between the cities of Los Angeles and San Diego, California, MCB Camp Pendleton covers approximately 125,000 acres, almost entirely in San Diego County (Figure 1-1). Surrounding communities include San Clemente to the northwest, Fallbrook to the east, and Oceanside to the south (Figure 1-1). The base is bordered to the west by the Pacific Ocean and encompasses 17 miles of undisturbed coastal area; rolling hills and valleys range inland an average of 10 to 12 miles.

MCB Camp Pendleton and the U.S. Department of the Navy (DON) have been actively engaged in the Installation Restoration Program (IRP) since 1980. The IRP is designed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by Superfund Amendment and Reauthorization Act (SARA) of 1986, to provide investigation and remediation, if necessary, to environmental impact caused by hazardous substances, pollutants, or contaminants. In general, the IRP consists of the following phases:

- Preliminary Assessment/Site Inspection (PA/SI): The PA/SI process involves records reviews, site inspections, and preliminary sampling and data collection to identify sites that could require further investigation or remediation.
- Remedial Investigation/Feasibility Study (RI/FS): The RI process involves assessing the nature and extent of contamination to a level of detail sufficient to support the development of remedial alternatives, which are then evaluated and finalized through the FS process.

- Remedial Design/Remedial Action (RD/RA): The RD process involves developing technical designs and analyses for the remedial alternative selected through the FS process. The detailed design plans and specifications from the RD phase are implemented during the final RA process.

A Federal Facility Agreement (FFA) for the base was signed on October 24, 1990, and constitutes a legally binding agreement between the U.S. Environmental Protection Agency (U.S. EPA), the California State Department of Toxic Substances Control (DTSC), the California Regional Water Quality Control Board (RWQCB), and the DON. The FFA outlines the working relationship between the parties to the agreement and clearly defines the mutual obligations of the parties as structured to attain efficient remedial response throughout the process. In addition, the FFA establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the base in accordance with the IRP.

Based on the PA/SI data, the FFA segregated the IRP sites into four groups:

- **Group A** – Sites with previous investigations prior to the RI/FS
- **Group B** – Landfills and surface impoundments
- **Group C** – Remaining sites in the Santa Margarita river basin
- **Group D** – Remaining sites outside the Santa Margarita river basin

In this grouping process, IR Site 1F was placed in Group D. The RI phase for Group D sites was performed during June and July 1996 (SWDIV, 1997). The FS for IR Site 1F was conducted as part of Operable Unit 3 (OU3) and was finalized in May 1998 (SWDIV, 1998a)

The final remedy for IR Site 1F was selected and documented in the Record of Decision (ROD) for OU3 (SWDIV, 1999a) that was issued in January 1999 and signed by the parties to the FFA during February and March 1999.

IR Site 1F is located in 43 Area (Figure 1-2), near the center of the base. Between 1942 and the early 1970s, refuse generated by operations in 43 Area was burned and then buried on the site. The RI results indicated that site soil posed unacceptable exposure risk to both ecological receptors and human health. The OU3 ROD requires that the burn debris and contaminated soil be removed from the site to the extent that the residual environmental impact and exposure risk, if any, would be acceptable. To achieve this requirement, risk-based remediation standards were developed during the RI/FS process and were then specified in the OU3 ROD. Based on the remediation standards, an RD/RA work plan (SWDIV, 1999b) was developed to provide a detailed approach for conducting remedial excavation, cleanup confirmation, and final site

restoration. Contaminated soil removed from IR Site 1F was disposed of in a corrective action management unit (CAMU) located at IR Site 7, Box Canyon Landfill (Figure 1-2).

In accordance with the RD/RA work plan (SWDIV 1999b), IT implemented the RA and excavated and removed about 55,250 cubic yards of burn debris and contaminated soil from the site between June 28 and September 20, 1999. The RA effort was summarized in an interim as-built report and addendum (SWDIV, 1999c and 1999d), which were reviewed by the parties to the FFA. The final site restoration plan (presented in the interim confirmation report) was approved by the parties to the FFA during the 56th FFA meeting held on May 15, 2000. The site grade was restored between July 12 and August 10, 2000. A total volume of about 41,184 cubic yards of clean soil was imported form a borrow site located in 22 Area of the base (Figure 1-2) for use as backfill to restore the surface grade. In October 2000, the site was seeded with a mix of native plants approved by the base biologist and the U.S. Natural Resources Conservation Service. Because the RA met all the remediation standards specified in the ROD, no further action was required and the RA at IR Site 1F is now considered complete.

1.2 Report Objectives

The primary objective of this report is to summarize the RA activities performed at IR Site 1F by IT during 1999 and 2000. In addition, chronological events related to the development of the RA, such as the RI/FS, ROD, and RD, are summarized. This report provides the documentation needed for the closure of IR Site 1F from the base IRP listing and future actions.

1.3 Report Organization

This report was prepared in accordance with the U.S. EPA guidance for preparing an RA report (U.S. EPA, 2000). The report was organized to include the following information:

- **Section 1.0** – Introduction
- **Section 2.0** – Site Description and Background
- **Section 3.0** – Construction Activities and Chronology of Events
- **Section 4.0** – Performance Standards and Construction Quality Control
- **Section 5.0** – Final Inspection and Certification
- **Section 6.0** – Operation and Maintenance Activities
- **Section 7.0** – Summary of Project Costs
- **Section 8.0** – References.

In addition to general discussions provided in each section, supporting documents include the following:

- **Appendix A** – Preconstruction Biological Survey Report
- **Appendix B** – Photographs of Remedial Action
- **Appendix C** – Site Backfill Geotechnical Contractor Quality Control (CQC) Report
- **Appendix D** – Site Revegetation Seed Mix
- **Appendix E** – Analytical Data Summary and Evaluation
- **Appendix F** – Review Comments.

2.0 Site Description and Background

This sections summarizes the conditions and operational background of IR Site 1F, as well as the RI/FS results, ROD requirements, RD, and the RA work plan that led to the final RA.

2.1 Site Description

This section summarizes the location, operational background, and environmental setting of IR Site 1F. The summary information in the following sections was obtained from the supplemental RI/FS for OU3 (SWDIV, 1998a).

2.1.1 Location

IR Site 1F, a refuse burning ground in 43 Area, is located approximately 250 feet northeast of Basilone Road, immediately northwest of its intersection with Las Pulgas Road (Figure 2-1). The refuse burning ground is approximately 600 feet long and 400 feet wide (about 5.5 acres). Basilone Road borders the site on the west. The site drains into Las Pulgas Creek, an intermittent creek approximately 1,100 feet to the southeast.

2.1.2 Operational Background

IR Site 1F is one of nine refuse burning grounds used from 1942 through the early 1970s to burn refuse generated by base operations. The burning grounds were not necessarily operated concurrently. No information is available on the specific years of operation or the volume of refuse disposed of by burning at each burning ground. Until 1970, all refuse at the base was disposed of by burning. The entire base generated an estimated 20,000 to 28,000 tons of various solid wastes annually, the entire volume of which is assumed to have been distributed to the nine burning grounds.

IR Site 1F was closed, covered with native soil, and allowed to revert to natural vegetation. Visual inspection of Site 1F during the 1984 on-site survey revealed no evidence of environmental contamination. However, the cover material was subsequently eroded, thereby exposing refuse at the site. Areas of stressed vegetation and stains were also observed.

2.1.3 Environmental Setting

This section summarizes the topography, geology, hydrogeology, ecology, and land use in the vicinity of Site 1F prior to the RA.

Topography – The site has an average elevation of approximately 255 feet mean sea level (msl) and slopes downward gently to the southeast (Figure 2-1). The surrounding area generally consists of low rolling hills.

Surface-Water Hydrology – No perennial surface water is present in the vicinity of Site 1F. Surface water at the site is ephemeral and follows the gently sloping ground surface to the southeast. During significant rainfall events, surface water generates intermittent runoff that flows through a stream bed in the middle of the site and enters a small tributary that discharges into Pulgas Creek. Pulgas Creek is an intermittent stream approximately 1,100 feet southeast of IR Site 1F; the creek flows southwesterly, eventually discharging into the Pacific Ocean.

Geology – Shallow geology at this site consists of unconsolidated and semiconsolidated alluvium overlying the La Jolla Group. The alluvium is fine- to medium-grained sand, silty sand, and clayey sand, with thin, discontinuous lenses of clay.

Groundwater Hydrogeology – Based on site geology, groundwater is assumed to flow to the southeast (following surface topography). During the RI phase, soil borings were drilled to a maximum depth of 50.25 feet below ground surface at IR Site 1F, and groundwater was encountered at a depth of 17.5 feet in boring 1FB-03 (Figure 2-2).

Ecology – IR Site 1F was disturbed by brushfire in June 1997, and the majority of the site was burned again in October 1998 prior to the 1999 RA. Most of the original habitat (presumed to be coastal sage scrub and disturbed habitat, which was the only marginal habitat for coastal California gnatcatchers) was lost. The site was sparsely vegetated with fennel, coyote brush, thistle, mustard, and wild oat.

No coastal California gnatcatchers were observed at IR Site 1F during surveys conducted prior to the fire. Although no least Bell's vireos were observed at the site, surveys conducted in 1996 identified least Bell's vireos in riparian vegetation along Pulgas Creek.

Surrounding Land Use – Disposal operations at the burning grounds in 43 Area ended in the early 1970s, and military and civilian personnel were present on site only infrequently thereafter. The area surrounding the site to the north and east was used primarily as an impact area for small arms, artillery, and aircraft. The area southeast of the burning ground, beyond Basilone Road, was undeveloped and classified as a "maneuver area." West of IR Site 1F, across Basilone Road, 43 Area contains several hundred buildings that are used for a variety of purposes, including personnel training, troop housing, mess, recreation, administration, vehicle fueling and

storage, maintenance and repair, and artillery storage and repair. No family housing is located within several miles of the site and none is planned.

The future (postremediation) land use at the site has not been documented. However, the likelihood of future residential land use is considered low given current development plans and current land use in the vicinity of the site.

Base production wells in the Las Flores Basin are approximately 5 miles south-southwest of IR Site 1F. Future use of groundwater at the site is considered unlikely.

2.2 Summary of RI/FS Results

This section provides a summary of the RI/FS results. The investigations performed for IR Site 1F include the following:

- An RI for Group D Sites was conducted during June and July 1996 and was documented in the *Draft Final RI Report for Group D Sites, Remedial Investigation/Feasibility Study* (SWDIV, 1997).
- A supplemental RI was conducted from May through July 1997 and was documented in the *Draft Final Remedial Investigation and Feasibility Study for Operable Unit-3* (SWDIV, 1998a).
- A field investigation was conducted in May 1998 and is documented in the *Energy Dispersive X-Ray Fluorescence (EDXRF) Field Investigation Report, Sites 1A, 1D, 1E, 1F, and 2A* (SWDIV, 1998b).

Information extracted from the above reports is summarized with regard to the following:

- Nature and extent of contamination
- Environmental impact
- Development and selection of remedial goals
- Development and selection of remedial alternatives.

It should be noted that the following sections contain citations of regulatory criteria, goals, levels, and/or standards that may have changed over time. The current regulations may not be consistent with the ones cited in the study summarized in this section.

2.2.1 Nature and Extent of Contamination

IR Site 1F was identified through interviews with base personnel and a review of aerial photographs during the PA/SI phase. Site reconnaissance and geophysical surveys were conducted to locate the boundaries of the site. The RI work involved surface and subsurface soil

sampling to investigate potential contamination from the burning ground and to evaluate impact to human health and ecological receptors.

The conclusions of the RI for Group D sites (SWDIV, 1997) indicated that groundwater at IR Site 1F was not of concern and that only soil was impacted. Soil analytical results obtained during the RI were used to determine the estimated areal extent of contamination, as shown in Figure 2-2. The characteristics of the contamination are summarized in the following paragraphs.

Organic Compounds – No organic compounds were detected in Site 1F soil samples at concentrations exceeding preliminary remedial goals (PRGs) or preliminary limits of exposure (PLEs). Chlorinated pesticides (4,4'-dichlorodiphenyldichloroethane [DDD]; 4,4'-dichlorodiphenyldichloroethene [DDE]; and 4,4'-dichlorodiphenyltrichloroethane [DDT]) were detected at low concentrations between the 5- and 10-foot intervals in borings 1FB-03 and 1FB-04; the maximum chlorinated pesticide concentration was 0.026 milligram per kilograms (mg/kg) for 4,4'-DDE (SWDIV, 1998a).

Inorganic Compounds – Six metals were detected at concentrations exceeding PRGs: antimony, arsenic, beryllium, cadmium, lead, and copper. All but three of the arsenic concentrations and all of the beryllium concentrations that exceeded PRGs were below background levels. Antimony, cadmium, copper, and lead concentrations that exceeded PRGs also exceeded background levels. These concentrations occurred in the 5-foot interval samples from borings 1FB-03 and 1FB-04.

Concentrations of antimony, arsenic, boron, chromium, cobalt, copper, iron, lead, manganese, molybdenum, silver, and zinc exceeded PLEs. With the exception of boron, for which no background concentration is available, the maximum concentrations of these inorganic constituents also exceeded background concentrations. The iron concentration reported at a depth of 20 feet at location 1FB-02 exceeded the PLE and the background concentration. However, the iron detection was not of ecological concern because it is at a depth greater than 5 feet.

The May 1998 field investigation (SWDIV, 1998b) involved the collection and analysis of 67 soil samples from hand-auger boring locations at IR Site 1F in order to refine the site boundary; 11 of the samples were collected from background locations. The samples were analyzed for antimony, arsenic, copper, iron, lead, and zinc.

As the EDXRF sampling effort proceeded and the EDXRF screening results were compared against the remedial goals established in the FS, nearly all detections exceeded the remedial goals. A comparison of the EDXRF results and fixed-facility laboratory results showed that the EDXRF results were biased high. To use the EDXRF results for refining the site boundary, EDXRF revised comparison goals were developed. These comparison goals were established by collecting soil samples from site-specific background locations for IR Site 1F, analyzing them using EDXRF, and calculating new site-specific background values. In instances where all new background data were nondetect, the original goal was retained. In a few cases where the background value was less than the PRG or PLE, the original PRG or PLE value was retained.

Based on the new data collected at IR Site 1F in May 1998, the estimated areal extent of contamination was developed, as shown in Figure 2-2, along with the boundary presented in the FS and the boundary of debris noted in the soil borings.

2.2.2 Environmental Impact

The environmental impact of the site was evaluated by performing a human health risk assessment (HHRA) and an ecological risk assessment (EcoRA). A detailed discussion of the assessments is presented in the RI for Group D sites (SWDIV, 1997). The summary information in the following sections was obtained from the RI/FS for OU3 (SWDIV, 1998a).

Human Health Risk Assessment – No organics were retained as chemicals of concern (COCs) in the Site 1F HHRA; however, the metals antimony, arsenic, copper, and lead were retained as final COCs. The solubilities of these inorganic constituents in the environment are sometimes controlled by the availability of certain anions (e.g., carbonate/bicarbonate, sulfate, or hydroxide, etc.). These inorganics are stable in the environment and do not degrade. Although the implied allowable soil contamination levels calculated using the designated level methodology (DLM) (RWQCB, 1989) indicated that antimony and lead in soil at IR Site 1F could potentially pose a threat to groundwater, these two metals were not detected in site groundwater. This indicates that antimony and lead appear to be retained in soil more than predicted by the DLM calculations.

The conceptual site model indicates that current/future workers and future residents could be exposed to soil contaminants through incidental ingestion of soil, dermal contact with soil, and inhalation of soil particulates.

The cumulative residential risk for the maximum concentrations of chemicals of potential concern (COPCs) is 3.5×10^{-5}. Excluding that portion of the total risk attributable to naturally

occurring metals, the U.S. EPA Region IX and California EPA (Cal/EPA) incremental residential site risks are $2.0x10^{-5}$ and $2.2x10^{-5}$, respectively.

By replacing the maximum concentrations of metals with the 95 percent upper confidence limits (UCLs), the U.S. EPA Region IX and Cal/EPA incremental residential site risks are $9.9x10^{-6}$ and $1.2x10^{-5}$, respectively, and are within the risk management range.

The cumulative residential noncarcinogenic hazard for maximum detected COPCs is 8.7. The cumulative residential background hazard is 1.2. Excluding that portion of the hazard attributable to background, the incremental site hazard is 7.5, which exceeds the threshold criterion of 1.0. By replacing the maximum concentrations of COPCs with the 95 percent UCLs and excluding that portion of the hazard attributable to background, the incremental site hazard is 7.3, which still exceeds the threshold criterion of 1.0.

The potential residential risks at IR Site 1F are within the risk management range, but the potential residential noncarcinogenic hazard exceeds the acceptable hazard criterion of 1.0. The majority of the residential hazard is attributable to copper and antimony. The maximum lead concentration (1,260 mg/kg) exceeds the U.S. EPA residential soil screening value of 400 mg/kg and the Cal/EPA residential soil PRG of 130 mg/kg.

IR Site 1F represents an acceptable cancer risk for the residential land use scenario, but has an unacceptable noncarcinogenic hazard due to antimony, copper, and lead.

Ecological Risk Assessment – The baseline EcoRA provides a qualitative and/or quantitative appraisal of actual or potential effects of contaminants on plants and animals (other than humans and domesticated species).

For IR Site 1F, 14 preliminary inorganic chemicals of potential ecological concern (COPECs) exceeded available background values and were retained for the initial ecological risk screening, along with all preliminary organic COPECs and boron. The results of the initial risk screening indicated that the maximum concentrations of 13 inorganic constituents exceeded PLEs. COPECs with hazard quotients (HQs) greater than 1.0 were grouped into areas of concern based on the sample locations at which PLEs were exceeded for any representative species. The PLEs for birds and mammals were modified based on the size of the area of concern and the foraging range for each representative species. The modified PLEs were then used to conduct the final risk screening.

COPECs with HQs exceeding 1.0 included antimony, arsenic, boron, chromium, cobalt, copper, iron, lead, manganese, molybdenum, silver, and zinc. Antimony, copper, iron, lead, and zinc were retained as chemicals of ecological concern (COECs). Arsenic, boron, chromium, cobalt, manganese, molybdenum, and silver were not retained as final COECs because of the associated low potential risks indicated by low HQs, near background concentrations, and/or low frequency of detections.

2.2.3 Development and Selection of Remedial Goals

The remedial objective for IR Site 1F was to minimize exposure to chemicals in soil at concentrations exceeding the background concentrations, PRGs (for humans), levels considered protective of groundwater, and/or PLEs (for plants, invertebrates, birds, and mammals). Each criterion was considered in the selection of contaminant-specific remedial goals.

For a given COC, the corresponding human health risk-based standard (i.e., PRGs under a residential scenario) was compared against the background concentration. The background values used were established during the RI and were agreed upon by the regulatory agencies. The higher value of the two is considered the remediation goal for human health protection.

From an ecological perspective, the remediation goal was selected by comparing the background concentration with an appropriate ecological risk management goal and retaining the greater of the two values. The ecological risk management goal for each COC was set at the most stringent PLE for the species of most concern at each site.

The lower of the two values (i.e., human health or ecological) was then selected as the proposed remediation goal for the COC in soil ranging between 0 and 5 feet below ground surface. The remediation goal for human health protection was selected as the proposed remediation goal for COCs in soil ranging between 5 and 10 feet below ground surface.

Finally, the soil concentration limits for the protection of groundwater that were calculated based on the DLM were compared with the proposed remediation goals selected for the protection of human and ecological receptors. The most stringent values were selected as the final proposed remediation goals.

The compounds retained as final COCs for the site were antimony, arsenic, copper, iron, lead, and zinc. The finalized remedial standards for the COCs at IR Site 1F are presented in Table 2-1.

2.2.4 Development and Selection of Remedial Alternatives

Remedial technologies, including institutional action, capping, excavation, landfilling, chemical treatment, physical treatment, biological treatment, and thermal treatment, were evaluated during the development of remedial alternatives. Three remedial alternatives were developed during the FS process as potential RAs for the site:

- **Alternative 1** – No Action
- **Alternative 2** – Excavation/Removal and On-Base Disposal
- **Alternative 3** – Excavation/Removal and Off-Base Disposal.

Remedial alternatives were assessed based on the following evaluation criteria:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost.

Based on the comparative analysis detailed in the RI/FS for OU3 (SWDIV, 1998a), Alternative 2 was selected as the most effective remedy for IR Site 1F. This alternative includes removal of contaminated soil via mechanical excavation. Upon removal, the impacted soil from IR Site 1F was transported to IR Site 7 (Box Canyon landfill), which has been designated as a CAMU for on-base disposal.

Implementation of Alternative 2 was intended to reduce potential future risks to human health and the environment by reducing COCs to PRGs, background, low incremental ecological risk concentrations, and/or levels protective of groundwater. Future exposure pathways, if any, would be eliminated by backfilling the excavation areas with clean backfill. Because the majority of the impacted soil would be permanently removed from the site, future soil remedial activities would not be necessary. The effectiveness of the soil excavation would be evaluated by collecting and analyzing confirmation samples during excavation.

2.3 Record of Decision

The final remedy for IR Site 1F was issued under the ROD for OU3 sites in January 1999. The ROD was signed by parties to the FFA during February and March 1999. Based on the OU3 ROD, RA activities to be taken at IR Site 1F included the following:

- Excavation of contaminated soil; the maximum excavation depths were 5 feet for ecological concerns and 10 feet for human health concerns.
- Confirmation sampling on the bottom and sidewalls of the excavations in accordance with U.S. EPA (1989) guidance.
- Transportation and disposal of soil meeting the technical and legal requirements (i.e., specified in Title 40, Code of Federal Regulations [CFR], Section 264.552[c]) at an on-base landfill (IR Site 7 – Box Canyon landfill) designated as a CAMU.
- Backfilling of the excavation with clean soil upon confirmation that cleanup goals were met and, if goals were not met at the maximum excavation depths (i.e., 5 feet for ecological concerns and 10 feet for human health concerns), placing 5 or 10 feet of clean fill.
- Site regrading and revegetating.

2.4 Remedial Design

According to the ROD, previous disposal and refuse burning activities impacted soil at IR Site 1F. The metals concentrations in the site soil would present unacceptable risks to human health and the environment. Based on the RI/FS results, removal of soil containing COCs with concentrations exceeding the remedial standards (Table 2-1) was determined to be the most effective way to achieve protection of human health and the environment. The detailed approach for conducting the soil removal action was provided in the RD/RA work plan (SWDIV, 1999b), which was reviewed and approved by the parties to the FFA. The RA sequence and decision process, as developed in the RD/RA work plan, is summarized in Figure 2-3. The remedial action at IR Site 1F consisted of the following work:

- Surveying the preexcavation site and laying out the boundary of excavation as identified by the RI/FS process
- Clearing existing vegetation in the excavation area and preparing the site for excavation, temporary soil stockpiles, and transportation operations
- Collecting perimeter confirmation samples at 100-foot intervals to verify the planned excavation boundary
- Conducting removal excavation activities to meet the remedial standards

- Collecting excavation confirmation samples in accordance with the confirmation sampling and analysis program prescribed in the RD/RA work plan
- Transporting the excavated soil to the Box Canyon landfill and placing it in the designated CAMU in accordance with the CAMU design
- Backfilling the excavated areas in accordance with the backfill design and restoring the site drainage grade and vegetation
- Surveying the postexcavation site and preparing an as-built report to document the RA process, confirmation sampling results and analyses, the effectiveness of the RA, and the as-built status of the site.

The following sections summarize the RD approaches and RA decision process.

2.4.1 Site Preparation

The planned excavation boundary is shown in Figure 2-4. The extent was based on conclusions from the May 1998 EDXRF investigation (SWDIV, 1998b). The layout of the traffic route, equipment laydown area, and soil stockpile area is also shown in Figure 2-4. Confirmation samples would be collected every 100 feet along the excavation boundary and/or, alternatively, at areas of visible stains or surface contamination to verify the extent of contamination. The results from perimeter sampling would be used to determine whether subsequent changes to the horizontal and/or vertical extent of the planned excavation would be needed.

Additional site preparation work such as underground utility clearance, surface-water management, traffic control, environmental control, and pollution prevention management were also developed and included in the RD/RA work plan and are discussed in Section 2.4.6.

2.4.2 Remedial Excavation

Based on the RD/RA work plan, the remedial excavation would be started in the shallow areas and proceed to the deeper excavation areas. A track excavator would be used for the excavation. The planned excavation depth is shown in Figure 2-4. The excavation strategy was to minimize the excavation depth while meeting the remedial objectives. In areas where the remedial goal was to remove contaminants to eliminate ecological risk and there was no exposure risk to human health, the maximum initial excavation depth would be 5 feet below ground surface. The same strategy would be used for the removal of contaminants posing risk to human health exposure. In the latter case, the maximum initial excavation depth would be limited to 10 feet below ground surface. If the contamination could not be fully removed at the maximum initial excavation depths, further RA, including limited hot spot removal or effective remedial backfill, would be implemented, as required, to remediate the site.

As shown in Figure 2-4, front-end loaders or dump trucks would transport excavated soil to two centralized stockpiles. The stockpile locations were designed to facilitate a traffic routing pattern that would maximize the efficiency of transportation of the excavated soil. The size of the stockpile was designed to encompass an approximate day's worth of work (about 2,000 cubic yards) that could be transported to the CAMU at Box Canyon landfill. The equipment used for excavation and management of contaminated soil would remain within the excavation area. Equipment outside the excavation area would be maintained clean throughout the construction.

Excavations would be conducted only in dry weather and low wind conditions. Depending on weather conditions, plastic visqueen and other additional dust control devices would be used. Water would be used as the primary dust control media. Workers in the excavation area would be protected in accordance with the site-specific health and safety plan.

2.4.3 Confirmation of Remedial Action

The OU-3 ROD requires that confirmation sampling be performed on the bottom and sidewalls of excavations in accordance with U.S. EPA (1989) guidance. According to the RD/RA work plan, the confirmation sampling program would start with collection of perimeter confirmation samples along the preexcavation boundary. Samples would be collected at 100-foot intervals along the perimeter and from half and full depths of the planned excavation. These perimeter samples would be used as the wall confirmation samples. Floor samples would be collected from the excavated surface and from 2 feet below the bottom of the excavation after the planned depth was reached. The surface samples would be analyzed first to assess the effectiveness of excavation. Should the surface sample exceed the remedial goals, below-grade samples would be analyzed to assess the extent of contamination.

The primary criterion for confirming that the cleanup standards are met is that 95 percent UCL of the confirmation sample mean must be equal to or less than the specified cleanup standard. To achieve this, floor confirmation samples would be systematically collected from a square grid pattern of 67 by 67 feet. The starting point of the sample grid would be randomly selected prior to the remedial excavation. The grid space and number of samples were designed and determined in accordance with the statistical test method provided in the U.S. EPA (1989) guidance. The sampling grid was designed such that the confirmation sampling data would meet certain data quality objectives to be verified by statistical tests. The data quality objectives were to achieve the following:

- Less than 5 percent probability that a residual hot spot with a size larger than a radius of 40 feet was left undetected

- A confidence level of 95 percent (false positive rate of 5 percent) at a risk of 20 percent (false negative rate of 20 percent) when the site was declared remediated with regard to meeting the cleanup standards.

If the above objectives could not be met through statistical tests, data would be evaluated manually following the data evaluation process presented in Figure 2-5. Because the site contained multiple COCs, it would be possible that removal of some of the COCs would be more difficult than for others. In such a case, multiple criteria would be applied, on a case-by-case basis, for developing the most appropriate action for achieving site closure. The evaluation criteria would include the extent, concentrations, and characteristics of the residual contamination; the risk associated with exposure to such contamination; the cost-effectiveness of additional removal excavation and effective remedial backfill; and future use of the site. Depending on evaluation of the above criteria, the subsequent RA included the following alternatives:

- **No Further Action** – The evaluation indicates that the risk associated with exposure to such residual contamination is low due to the characteristics (i.e., residual concentration, final location, and exposure pathway) of the contaminant and future use of the site. In such a case, the site would be backfilled and restored.
- **Hot Spot Removal** – If the evaluation indicates that the residual contamination is limited and could be economically removed with additional excavation or that the exposure risk could be effectively reduced by additional excavation, hot spots would be identified and removed with additional excavation. Additional confirmation samples would be collected and new data would be added to the original data pool for analysis.
- **Remedial Backfill** – If the evaluation indicates that the contamination could not be economically removed to meet the remedial goals and/or effectively reduce the exposure risk, the maximum excavation depths would remain 5 feet below ground surface for contamination involving ecological risk and 10 feet below ground surface for human health risk. The site would then be backfilled and restored with clean soil to a minimum depth of 5 feet to eliminate future risk of ecological exposure to residual contamination or to 10 feet to eliminate human health exposure. The area requiring remedial backfill would be identified so that the final grade of the restored site could meet the minimum depth requirements, as well as drainage and erosion control needs.

2.4.4 *Transportation and Disposal*

According to the RD/RA work plan, excavated material from IR Site 1F would be placed in dump trucks and covered with tarps prior to being transported to the CAMU at the Box Canyon landfill (IR Site 7). The transport trucks would access the site via a dedicated haul road (Figure 2-4), maintained and kept free of impacted soil from the excavation area. Signs and

guide markers would be used to prevent trucks transporting impacted soil to the landfill from driving over contaminated soil at the excavation site. A separate decontamination area would be maintained at the site to clean the tires and other exterior surfaces of any transfer trucks, if necessary, prior to their leaving the site.

The excavated soil from IR Site 1F would be contained in the designated CAMU at the Box Canyon landfill. The RD concluded that an estimated 32,488 cubic yards of excavated soil would be deposited in the CAMU and eventually covered with a minimum of 6 feet of clean soil designed for the closure of Box Canyon landfill.

2.4.5 Site Restoration

The backfill grade in the RD was to eliminate the residual risk, if any, associated with the COCs and to restore the existing drainage patterns on the site. After the site grade was restored, the disturbed areas would be revegetated with native plant species to restore the vegetation.

2.4.6 Environmental Control Plan

An environmental control plan (ECP) was prepared to provide specific information related to the excavation and disposal of contaminated soil to ensure adequate environmental protection during remedial activities. Specific environmental protection issues addressed by the ECP were as follows:

- Land resources management
- Water resources protection (spill prevention and control)
- Storm-water pollution prevention plan (SWPPP) (meeting RWQCB storm-water discharge permit requirements per the National Pollutant Discharge Elimination System mandate)
- Wildlife resources management (biological monitoring in accordance with biological assessment recommendations)
- Dust/airborne contaminant control and monitoring
- Traffic control (in accordance with CalTrans manual [CalTrans, 1996])
- Noise control
- Erosion control and winterization (in accordance with RWQCB best management practices).

2.4.7 Regulatory Permitting

Although permits are not required for implementing a CERCLA RA, all construction activities were conducted in full compliance with the substantive requirements of applicable permits. A Notice of Intent (NOI) and SWPPP were submitted to the RWQCB as required for any construction activities involving grading work greater than 5 acres.

3.0 Construction Activities and Chronology of Events

In accordance with the RD/RA work plan (SWDIV, 1999b), the remedial action process at IR Site 1F consisted of the following tasks:

- Surveying the preexcavation site and laying out the excavation boundary identified by the RI/FS process
- Clearing existing vegetation in the excavation area and preparing the site for excavation, temporary stockpiling, and transportation operations
- Collecting perimeter confirmation samples at 100-foot intervals to verify the planned excavation boundary
- Excavating soil to meet the remedial goals
- Collecting excavation confirmation samples in accordance with the confirmation sampling and analysis program, and evaluating the confirmation data in accordance with the decision process
- Transporting the excavated soil to the Box Canyon landfill (Site 7) and placing it in the designated CAMU in accordance with the CAMU design
- Backfilling the excavated areas in accordance with the backfill design and restoring the site drainage grade and vegetation
- Surveying the postexcavation site and preparing an as-built report to document the RA process, confirmation sampling analyses and results, effectiveness of the RA, and as-built status of the site.

This section provides a chronology of the various construction activities conducted since the start of construction in June 1999. Based on the types of field activities, the chronology is divided into four stages: preexcavation, excavation, confirmation sampling, and final site restoration. Each stage is discussed separately in the following sections.

3.1 Preexcavation Activities

Before the start of soil removal activities at IR Site 1F, several tasks were performed to prepare the site for construction, including site surveying, perimeter confirmation sampling, preconstruction biological surveying, and site preparation.

3.1.1 Preconstruction Site Survey

In accordance with the work plan (SWDIV, 1999b), the planned excavation boundary, shown in Figure 2-4, was surveyed and marked on the ground. In general, surveyors placed stakes at

100-foot intervals along the excavation to delineate the excavation boundary. Additional stakes were positioned between curves. Each stake was offset 3 feet outward from the actual boundary to accommodate the sloping factor from the remedial excavation (i.e., the remedial excavation starts at the staked line). The stakes were identified by the site number and a four-digit number designated by the surveyors. All surveys were conducted under the supervision of a California-registered licensed land surveyor using the State Plane Coordinates based on the North American Vertical Datum (NAVD) of 1988.

3.1.2 Perimeter Sampling

Perimeter samples were collected at 100-foot intervals to verify the planned excavation boundary. A total of 20 perimeter sample locations were identified as part of the preconstruction boundary survey. The site boundary and stake locations are shown in Figure 3-1. Soil samples were collected on December 9 and 10, 1998, using a hand auger (SWDIV, 1999b). Two samples were collected from each boring, one at half of the planned excavation depth and the second at full depth. The perimeter samples were also used as wall confirmation samples. In accordance with the work plan, only the half-depth sample at each location was initially analyzed. The initial perimeter confirmation sampling results (Table 3-1) indicated that only one isolated location (sample 1F-1165) required further action. Additional step-out samples were collected at that location and other perimeter sampling locations (1F-1146 and 1F-1156) during the course of the excavation. Additional step-out sampling is discussed in Section 3.3.

3.1.3 Biological Assessment

As a result of a meeting with the U.S. Fish and Wildlife Services (USFWS) on May 20, 1999, it was decided that a preconstruction biological survey should be conducted to verify potential biological impacts, if any, as analyzed in the biological assessment (SWDIV, 1999e). The preconstruction biological survey for Site 1F was conducted on June 23, 1999, by a biologist qualified and permitted to survey for the California gnatcatcher, southwestern willow flycatcher, least Bell's vireo, California least tern, and arroyo southwestern toad. Findings from the survey confirmed the results of the biological assessment (SWDIV, 1999e). The assessment concluded that mitigation measures were not required at IR Site 1F because of insufficient reestablishment of vegetation following the brushfires of 1997 and 1998. Approval for clearing and grubbing activities was given on the day of the biological survey. A copy of the preconstruction biological survey report is presented in Appendix A.

3.1.4 Site Preparation

The majority of the site preparation activities were performed between June 21 and 25, 1999, and included the following:

- Mobilizing equipment and personnel
- Obtaining clearances for underground utilities
- Obtaining access to a water supply and approval on a backflow prevention device
- Setting up an on-site staging area, fuel storage and containment system, storage and restroom facilities, and personnel rest/decontamination areas in accordance with the work plan (SWDIV, 1999b)
- Installing temporary fencing (bright-orange plastic mesh fence) along the entire excavation boundary and warning signs (stating *Danger Hazardous Waste Area, Unauthorized Personnel Keep Out*) at locations opening to off-site traffic
- Building an on-site access road for truck operations
- Installing signs along the trucking route between IR Sites 1F and 7
- Clearing and grubbing vegetation
- Installing surface-water management (temporary diversion soil berms) and erosion control devices (silt fence and straw bales) at the stockpile location and along the streambed as preventive measures
- Installing survey control points, grade stakes, and interior excavation boundaries
- Establishing a grid system for collecting floor confirmation samples

According to the work plan, a grid pattern of 67- by 67-foot squares (Figure 3-1) was laid out from a randomly selected starting point. Floor confirmation samples were collected from the node points, as required.

The site preparation work was completed on June 25, 1999. The site plan is shown in Figure 3-2. In addition to the above activities, 20 test trenches were dug on June 24 and 25, 1999, at various locations throughout the site to confirm the depth and characteristics of the contaminated soil. Trenching activities revealed that burned debris exceeded the planned excavation depths in the west-central portion of the excavation area. It was decided that the confirmation samples collected from the excavation floor at the planned depth would determine whether additional removal action was required in that area.

No unusual types of wastes (e.g., unlabeled drums or containers with unknown contents) were identified during the site clearing and test trenching process.

3.2 Remedial Excavation Activities

Remedial excavation activities at IR Site 1F began on June 28, 1999. The excavation was generally conducted in the following three phases:

- Planned Excavation: Although the initial test trenching indicated that the waste depth in certain areas exceeded the planned excavation depth, it was decided that the first phase of the excavation would be terminated at the planned depth. Floor confirmation samples would be collected to assess whether residual contamination was present and further excavation was required.
- Overexcavation: If the floor confirmation sample collected at the planned excavation depth exceeded the cleanup standard, overexcavation was conducted to remove the contamination. At IR Site 1F, overexcavation essentially removed all visible waste debris. New floor confirmation samples were collected after the overexcavation was completed.
- Final Excavation: Additional excavation was conducted in localized areas to remove contaminated soil that exceeded cleanup standards. At IR Site 1F, the final excavation essentially removed all unacceptable contamination and established that cleanup objectives were met for the entire site.

The following sections summarize the excavation activities performed during each of the three phases and the total quantity of waste removed from IR Site 1F. Photographic documentation of the removal excavation process is presented in Appendix B.

3.2.1 Planned Excavation

The first phase of the remedial excavation process began on June 28, 1999. IR Site 1F is bisected by a gently sloping, southeast-flowing stream (Figure 3-2), which contained no flow during the dry summer months. The dry streambed was used to partition the entire IR Site 1F excavation area into three smaller areas: one to the west of the stream, one to the east of the stream, and a corridor along the streambed itself. To retain the existing drainage system and divert any potential upstream surface runoff from entering the excavation area during removal activities, the streambed was left in-place until excavation of the other two areas had been completed.

Excavation of contaminated soil began at the southwest corner, near perimeter locations 1F-1142 and 1F-1143, on June 28, 1999. On the following day, soil excavation also began in the eastern portion of the site, near perimeter locations 1F-1163 and 1F-1165. Two track excavators were used, one at each location. Target depths ranged from 3 to 7 feet and were verified daily using surveyor's grade stakes or sidewall measurements. Excavated waste and soil were transported to the temporary stockpile areas (Figure 3-2) by a bulldozer or wheel loader.

Stockpile loading areas were constructed for both the western and eastern areas. Wheel loaders or track excavators were used to transfer the stockpiled soil into a 20-cubic-yard end-dump truck.

Excavated waste and contaminated soil were transported to the CAMU at IR Site 7 (Box Canyon landfill) for final disposal. Signs identifying the trucking route were installed at all major road crossings. All trucks were required to use tarps to cover the waste. No trucks were allowed to leave the site without proper tarp covers. Remedial excavation continued in this fashion until July 27, 1999, when the planned excavation depths for the western and eastern areas were reached.

Excavation of the streambed did not begin until overexcavation activities in the east and west portions were completed. To remove the remaining portion of the streambed, a temporary road was constructed with clean material. The road entered the eastern portion of the site, looped around the northernmost section of the streambed, and exited on the western half of the site. Contaminated soil from the streambed was loaded directly into end-dump trucks for transport to the CAMU.

3.2.2 Overexcavation

Inspection of the floor throughout the planned excavation activities confirmed the observations made during the June test trenching. Burned debris was visible in large areas on both the western and eastern sides of the streambed. The initial floor confirmation sampling results (Table 3-2) indicated that these areas exceeded COC cleanup standards. Based on these results, it was decided that additional excavation would be conducted to remove all visible burned debris in order to meet the remedial cleanup goals for the site.

On July 20 and 21, 1999, prior to any additional overexcavation, additional test trenching was conducted in the debris areas to verify the depth of the remaining debris. Trenching revealed that the depth of the debris extended another 2 to 3 feet in the eastern area and up to 9 feet in some sections of the western area. The characteristics of the debris were consistent with the debris encountered at the floor of the planned excavation.

Overexcavation operations began on July 28 and continued until August 17, 1999. The methods used to remove the additional contaminated soil were similar to those used during the initial excavation. The overexcavation areas included all areas with visible debris and any locations identified by the initial confirmation results.

At the completion of the overexcavation phase, all visible debris had been removed from the two areas on the sides of the streambed. The streambed area remained intact and was removed as

part of the final excavation phase. Table 3-3 summarizes the floor confirmation sampling results at the end of the overexcavation. Interim data from overexcavated sampling locations are not included.

3.2.3 Final Excavation

Analytical results for samples collected following overexcavation activities indicated that three locations (sampling grid locations E2, G3, and H4 [Figure 3-1]) required additional excavation. In accordance with the "hot spot removal" procedure presented in Appendix B of the work plan (SWDIV, 1999b), final excavations around these grid locations were conducted by removing materials half the distance to the surrounding four grid nodes. Two of these grid locations (sampling grid locations E2 and H4) were excavated laterally an additional 2 feet to meet cleanup standards. Sampling grid location G3 was excavated laterally an additional 3 feet and sampled again. All three excavations were conducted from September 2 to 20, 1999, in conjunction with the streambed removal (Section 3.2.1). Final confirmation results and an evaluation of effectiveness of remedial excavation activities are discussed in Section 4.0.

3.2.4 Excavation Quantities

The total excavation quantities were based on in-place cubic yards of material transported to the CAMU. The daily trucking record is summarized in Table 3-4. A total of 4,277 loads were recorded. An approximate value of 13 in-place cubic yards per truck was calculated based on loading observations and calculations from surveys at the CAMU. According to this estimate, the total quantity of waste materials removed from IR Site 1F was about 55,250 cubic yards, or about 22,000 cubic yards more than estimated in the work plan.

3.3 Confirmation Sampling Activities

The OU-3 ROD (SWDIV, 1999a) identified the COCs for IR Site 1F as antimony, arsenic, copper, iron, lead, and zinc. Site-specific soil cleanup standards (Table 2-1) were specified for soil depths extending from ground surface to 5 feet below ground surface and from 5 to 10 feet below ground surface. For a given COC, HHRA-based standards (i.e., PRGs) and ecological exposure limits (i.e., PLEs) were compared against established site background concentrations and the higher value for each COC was selected as the cleanup standard. However, because both human and ecological receptors could potentially be exposed to the upper 5 feet of soil, the cleanup standards for human health and ecological concerns were evaluated jointly and the more stringent (lower) of the two values was selected as the final cleanup standard for the 5-foot depth.

In accordance with the work plan (SWDIV, 1999b), floor confirmation soil samples were collected at each node of a grid system composed of 67- by 67-foot squares (Figure 3-1). A hand auger was used to collect soil samples at depths of 6 inches and 2 feet below the bottom surface of the excavation. The 6-inch samples were analyzed first to assess the effectiveness of the remedial excavation. If the 6-inch sample exceeded the remediation goals, the 2-foot sample was analyzed to assess the extent of contamination. Surveyors maintained grid node locations and elevations throughout remedial excavation activities. Each sample was identified with a unique sample identifier consisting of the five-digit project number and a sequential number generated at the time of sample collection and documented on the chain-of-custody forms.

Collection of the excavation confirmation samples began on July 19, 1999. Excavation floor confirmation samples were collected continuously and systematically when the planned excavation depth was reached. In general, the samples were collected in three phases: planned excavation phase, overexcavation phase, and final excavation phase. The three phases are discussed in the following sections.

3.3.1 Planned Excavation Phase

Sampling for the planned excavation activities was completed on July 22, 1999. A total of 58 samples (not including quality control [QC] samples) were collected from the 40 grid point locations initially established (however, not all 58 samples were analyzed). Initial sampling results are presented in Table 3-2, along with cleanup standards for comparison.

Some of the grid locations were only sampled to a depth of 6 inches because visibly burned debris did not extend beyond the next sampling depth of 2 feet. In certain areas, samples were collected before the start of the excavation to provide information on the extent of the contamination. A total of 10 samples were collected from the streambed and stockpile loading areas in this manner because these areas remained intact during initial excavation activities and were excavated last. Sampling locations and elevations were surveyed after excavation activities were completed to verify that the planned removal depth had been achieved.

As discussed in Section 3.1.2, the preconstruction perimeter sampling results (Table 3-1) indicated that additional step-out sampling was required at sample location 1F-1165. On July 2, 1999, step-out samples were collected 10 and 20 feet from the previous 1F-1165 sample location. Results for these samples indicated that the existing boundary needed to be extended 20 feet in order to meet the required cleanup standard. The additional excavation was conducted during the overexcavation stage.

3.3.2 Overexcavation Phase

Based on an evaluation of the initial round of confirmation data, 21 additional floor confirmation samples were collected after overexcavation. Almost all of these locations still contained visible surface debris at the planned excavation depth. The results for these samples were received on August 31, 1999. One grid location, C5, was added during overexcavation activities following the removal of debris from the sidewall at perimeter location 1F-1146. Of these 21 locations, three (grid locations E2, G3, and H4) required additional soil removal during the final excavation phase. Confirmation sampling results for the overexcavation stage are presented in Table 3-3. The sequence of sampling at each grid point is indicated by a number following the sample location number (e.g., 1FB2-03 means the third sample collected from grid location B2).

3.3.3 Final Excavation Phase

After overexcavation activities were complete, sample results indicated that soil in the vicinity of grid locations E2, G3, and H4 required further removal. Analysis of the 2-foot samples collected from these locations indicated that only G3 would require additional excavation below the 2-foot depth. Following final excavation at G3, additional samples were collected from a depth of 6 inches below the new excavation floor and met the cleanup standards.

Two additional perimeter locations were also sampled during the course of the final removal action to remove debris outside the planned excavation boundary. These samples were stepped-out from perimeter locations 1F-1146 and 1F-1156. The step-out sample numbers are followed by the distance (in feet) between the step-out sample and the original sample (e.g., 1F-1165-20 means the step-out sample was 20 feet from the original 1F-1165 sampling location).

At this stage, the confirmation data from both the perimeter and floor sampling activities indicated that the remedial excavation at IR Site 1F satisfied the remedial cleanup standards for the entire site. The data used to establish this conclusion and the evaluation process are discussed in Section 4.0.

3.4 Site Restoration Activities

A site restoration plan was presented in the interim as-built reports (SWDIV, 1999c and 1999d). The results were discussed during the 52nd and 56th FFA meetings held on November 8 and May 17, 2000, respectively. The site restoration plan was approved during the 56th FFA meeting.

The final site restoration was conducted between July 12 and August 10, 2000. A volume of about 41,184 cubic yards of clean soil was imported from a borrow site located in 22 Area of the base (Figure 1-2) and was used as backfill to restore the surface grade. The site drainage pattern

was also restored to preexcavation conditions. The imported soil was compacted in 1-foot lifts to 85 to 90 percent of the maximum dry density, depending on location, as determined by American Society for Testing and Materials (ASTM) D 1557 method. A geotechnical subcontractor performed field method QC activities to verify that the backfill was properly compacted and graded in accordance with the final site restoration plan. The subcontractor's field QC report is presented in Appendix C. The final site grade is shown in the as-built topography map presented in Figure 3-3. During October 2000, the site was seeded with a mix of native plants that was approved by the base biologist and the U.S. Natural Resources Conservation Service. The seed mix specification is presented in Appendix D.

4.0 Performance Standards and Construction Quality Control

Based on the OU3 ROD (SWDIV, 1999a), remedial actions taken at IR Site 1F shall include the following:

- Excavation of contaminated soils: The maximum excavation depths were 5 feet for ecological concerns and 10 feet for human health concerns.
- Confirmation sampling on the bottom and sidewalls of the excavation in accordance with U.S. EPA (1989) guidance.
- Transportation and disposal of soil meeting the technical and legal requirements (i.e., specified in 40 CFR 264.552[c]) at an on-base landfill (IR Site 7 – Box Canyon landfill), a designated CAMU.
- Backfilling of the excavation with clean soil upon confirmation that cleanup goals were met; if goals were not met at the maximum excavation depths (i.e., 5 feet for ecological concerns and 10 feet for human health concerns), 5 or 10 feet of clean fill was placed, as appropriate.
- Site regrading and revegetating.

An RD/RA work plan (SWDIV, 1999b) was developed to establish specific methodology and performance standards for meeting each of the above requirements. This section provides a review of actions taken to meet each of the OU-3 ROD requirements listed above in terms of performance and/or quality standards specified in the RD/RA work plan.

4.1 Excavation of Contaminated Soil

The remedial excavation was conducted in accordance with the excavation plan (Figure 2-4). The excavation strategy was to minimize the excavation depth while meeting the remedial objectives. In the area where the remedial goal was to remove contaminants to eliminate ecological risk and exposure risk to human health was not a concern, the maximum initial excavation depth was 5 feet below ground surface. The same strategy applied for the removal of contaminants posing risk to human health exposure. In the latter case, the maximum initial excavation depth was 10 feet below ground surface. If the contamination could not be fully removed at the maximum initial excavation depth, further remedial activities, including limited hot spot removal or effective remedial backfill, were implemented as required to remediate the site.

Surveyors maintained grid node locations and elevations throughout the excavation process. The "as-built" condition at the completion of the remedial excavation was surveyed on September 27,

1999, and is shown in Figure 4-1. The final excavation depth and the planned excavation depth at each grid node are listed in Table 4-1. The excavation depth was determined when floor confirmation samples were collected. As shown in Table 4-1, final excavation depths at all nodes met or exceeded the planned excavation depth. To meet the cleanup standards, the extent of excavation was about 2.8 feet (average) deeper and 11,000 square feet wider than the original plan.

4.2 Confirmation of Excavation Effectiveness

A sampling grid system and sampling strategy were developed in the RD/RA work plan based on U.S. EPA (1989) guidance for evaluating cleanup efforts. The data quality objectives (DQOs) of this sampling approach were met by achieving the following performance standards:

- Wall/perimeter confirmation samples were collected at intervals of 100 feet along the excavation boundary identified by the RI/FS process.
- Floor confirmation samples were collected in a systematic grid pattern with a randomly selected starting point.
- The grid spacing was designed to allow a 95 percent probability of detecting any residual hot spot with a radius larger or equal to 40 feet.
- The total number of sample satisfied the statistical test requirement for verifying that the decision error was within the tolerance (i.e., false positive rate of 5 percent and false negative rate of 20 percent). In addition, the minimum sample number was 20.

To meet the DQOs, the size of the floor sampling grid was 67 by 67 feet. A total of 63 floor grid locations within the excavation boundary were sampled along with 20 perimeter locations.

Throughout the RA process, a total of 46 perimeter samples were collected from 21 locations (20 from the planned excavation boundary and 1 from the extended boundary) and 119 floor samples were collected from 41 grid points (40 points from the planned excavation and 1 point from the overexcavation). Only 84 of these samples were analyzed. The other samples were not tested primarily because a sample from the same sampling location indicated that the cleanup standard had already been achieved. The final excavation boundary, postexcavation site grade, and the final confirmation sampling locations are shown in Figure 4-1.

All confirmation samples were collected, preserved (only as required), shipped, and analyzed in accordance with the field sampling plan presented in the work plan (SWDIV, 1999b). The analytical data summary, chain-of-custody forms, and data validation summary report are presented in Appendix E. The original laboratory data reports and data validation details are too

voluminous to be included in this report. The data are maintained by the Navy administrative record archive and are available for review upon request.

In accordance with DQOs presented in the work plan, the primary criterion for confirming that the cleanup standards had been achieved was that the 95 percent upper confidence limit (UCL_{95}) for the confirmation sample mean was equal to or less than the specific cleanup standard. During the remedial excavation process, the UCL_{95} was calculated and updated continuously whenever new confirmation sampling data were added to the database. The calculated UCL_{95} was compared against the remedial standards for the excavation depth until the cleanup standard was met.

The results of final UCL_{95} computation and the associated perimeter and floor confirmation sampling results that were used for the final UCL_{95} computation are presented in Tables 4-2 and 4-3, respectively. The following additional information is also provided in the tables:

- Grid location – The node identifier represented by an alphanumeric designation.
- Sample location number – The number assigned to each sample, identifying the site number, grid location, and the sequential number of samples collected at the grid location.
- Sample depth – The depth below ground surface from which the sample was collected.
- Collection date – The date the sample was collected.
- The calculated mean, standard deviation, and UCL_{95}.

The final UCL_{95} data indicated that the remedial excavation successfully met the cleanup standards for all COCs and the statistical DQO criteria. In addition, the UCL_{95} was below the most stringent cleanup standard; as such, the site could be restored and backfilled without any thickness limitation other than to support future vegetation and drainage control. All residual contamination was within two times the cleanup standards that were background-based. Such isolated residual contamination should not pose any significant risk to human health or the surrounding environment.

4.3 Waste Transportation and Disposal Activities

Excavated waste and contaminated soil were transported with end-dump trucks to the CAMU at IR Site 7 (Box Canyon landfill) for final disposal. Signs identifying the trucking route were installed at all major road crossings. All trucks were required to use tarps to cover the waste.

No trucks were allowed to leave the site without proper tarp covers. The trucking route was maintained free of contamination at all times, and a separate decontamination area was maintained at the site to clean the tires and other exterior surfaces of any transfer trucks, if necessary, prior to their leaving the site.

The remedial excavation at IR Site 1F was initiated on June 28, 1999. Between June 30 and September 20, 1999, a total of 4,250 truckloads (Table 3-3) were recorded. Each truckload was about 20 tons in weight, or 13 cubic yards in volume. Therefore, the estimated volume of waste excavated was 55,250 cubic yards. The work plan had estimated a total of 32,488 cubic yards. It appears that the actual excavation was deeper (Table 4-1) and larger (Figure 4-1) than planned. Throughout the transportation and disposal activities, no traffic accidents or violations were recorded. The trucker's daily log/ticket was used as a proof of loads and showed the starting and ending time for each load during each day.

4.4 Site Backfilling and Restoration Activities

The effectiveness of the remedial excavation was evaluated in accordance with the U.S. EPA guidance (1989). The evaluation (Section 4.2) confirmed that the soil contamination at IR Site 1F has been remediated to meet the cleanup standards stipulated in the OU-3 ROD. As such, the site no longer posed a threat to the surrounding environment or human health. According to the work plan, the site grade should be restored to promote drainage and support vegetation growth. The backfill soil would be compacted in 1-foot lifts. The goal of the compaction effort was to achieve 85 percent maximum density, as determined by ASTM D 1557. Areas along the streambed and access road area were to be compacted to meet 90 percent of the maximum density to prevent erosion. The compaction effort was to be verified by field QC testing, as specified in the work plan.

The final site restoration was conducted between July 12 and August 10, 2000. A volume of about 41,184 cubic yards of clean soils was imported form a borrow site located in 22 Area of the base (Figure 1-2) and used as backfill to restore the surface grade. The site drainage pattern was restored to match preexcavation conditions. The imported soil was compacted in 1-foot lift to about 90 percent of the maximum dry density as determined by ASTM D 1557 along the streambed and road areas. The surface layer was scarified to enhance revegetation growth. A geotechnical subcontractor performed field QC activities to verify that the backfill was properly compacted and graded in accordance with the final site restoration plan. The subcontractor's field QC report is presented in Appendix C.

During October 2000, the site was seeded with a mix of native plants approved by the base biologist and the U.S. Natural Resources Conservation Service. The seed mix specification is presented in Appendix D. The success of the site revegetation effort can be demonstrated by photographs (Appendix B) taken in April 2001.

5.0 Final Inspection and Certification

The final remedial action at IR Site 1F was implemented in accordance with the RD/RA work plan (SWDIV, 1999b), which was specifically developed to meet the OU-3 ROD (SWDIV, 1999a). The remedial actions was performed in the following sequence:

- Site preparation: June 21 through 25, 1999
- Remedial excavation: June 28 through September 20, 1999
- Transportation and disposal of excavated wastes: June 30 through September 20, 1999
- Interim confirmation report and site restoration plan (SWDIV, 1999c): November 8, 1999
- Interim confirmation report addendum (SWDIV, 1999d): November 19, 1999
- Site restoration plan approved: May 17, 2000 (during 56th FFA meeting)
- Site restoration backfill: July 12 through August 10, 2000
- Site revegetation (hydroseeding): October 2000
- Draft remedial action site closure report: August 2002

During the RA, parties to the FFA visited the site on August 20, 1999 (as part of 51st FFA meeting), and observed the remedial excavation, transportation, and the CAMU disposal activities. The status of the RA, including interim confirmation data analysis, excavation boundary changes (both horizontal and vertical extent), and production quantities, were presented and discussed in FFA meetings subsequent to the start of the fieldwork. The final extent of the excavation indicated that it was, on the average, about 2.8 feet deeper and 11,000 square feet larger than the original plan. The total excavated quantity was about 22,762 cubic yards more than originally estimated (32,488 cubic yards).

The draft version of this report (SWDIV, 2002) was reviewed by the parties to the FFA for final concurrence on the effectiveness of the site remediation. A copy of the review comments is provided in Appendix F, which serves as the final inspection and certification of the RA at IR Site 1F.

6.0 Operation and Maintenance Activities

IR Site 1F has been remediated in accordance with the RD/RA work plan to meet the cleanup standards stipulated in the OU-3 ROD. The site no longer poses threats to human health or the surrounding environment. As such, 5-year reviews are not required. The site grade was restored and site vegetation was reintroduced during July and October 2000, respectively. No specific long-term postclosure operation, monitoring, or maintenance is needed.

7.0 Summary of Project Costs

The project cost was estimated to be $1.5 million in the OU-3 ROD. The actual cost was about $1,588,000. The breakdown of the actual cost is as follows:

Remedial Action Activities	Total Cost
RD/RA work plan, study, engineering planning	$65,000
Site preparation and clearing	$20,000
Remedial excavation	$250,000
Transportation of excavated wastes	$520,000
Disposal of excavated wastes at CAMU	$173,000
Confirmation sampling and survey control	$85,000
Site backfill	$220,000
Site revegetation	$30,000
Construction engineering monitoring	$50,000
Construction management	$100,000
Miscellaneous costs (5%)	$75,000
Subtotal	$1,588,000

It should be noted that the above total cost does not include the cost associated with the closure of the CAMU at IR Site 7.

8.0 References

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California Regional Water Quality Control Board, 1989, *Staff Report The Designated Level Methodology for Waste Classification and Cleanup Level Determination*, June

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Southwest Division Naval Facilities Engineering Command, 1999e, *Biological Assessment for Sites 1A, 1D, 1E, 1F, 2A, and 30, Marine Corps Base Camp Pendleton*, May 20.

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State of California Department of Transportation, 1996, *Manual of Traffic Control for Construction and Maintenance Work Zones*, December.

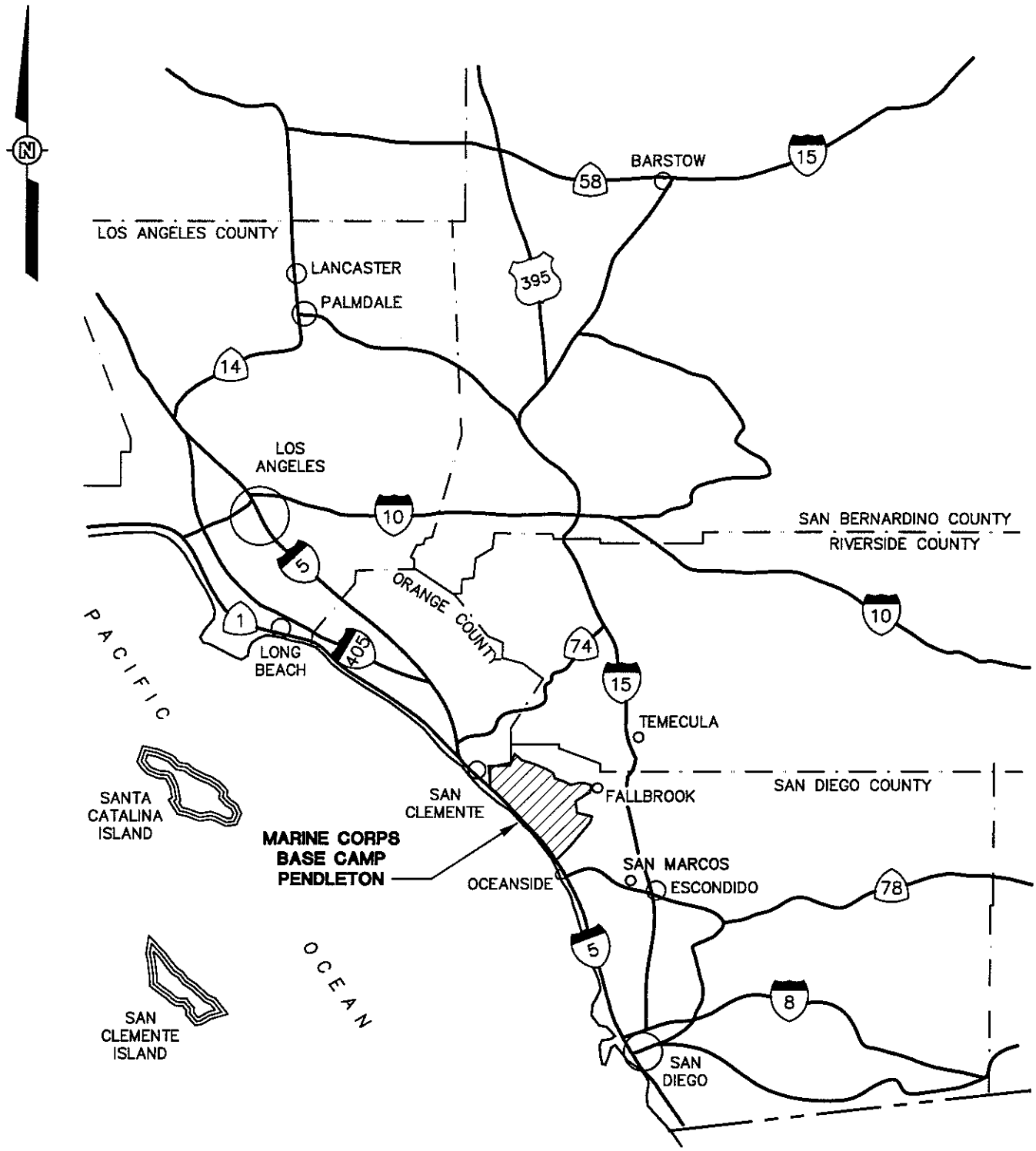
SWDIV, see Southwest Division Naval Facilities Engineering Command.

U.S. EPA, see U.S. Environmental Protection Agency

U.S. Environmental Protection Agency, 1989, *Methods for Evaluating the Attainment of Cleanup Standards Volume 1: Soils and Solid Media*, PB89-234959, Statistical Policy Branch (PM-223), Office of Policy, Planning, and Evaluation.

U.S. Environmental Protection Agency, 2000, *Closeout Procedures for National Priorities List Sites, EPA 540-R-98-016, OSWER Directive 9320.2-09A-P*, January.

FIGURES



SCALE

0 26 32 MILES

IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 1-1

BASE LOCATION MAP

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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64 63 62 61 55 54 53 52 51 45 44 43 42 41 34 33 32 31 28 27 25 26 24 23 22 19 17 16 15 14 13 12 20 21 18

SAN MATEO CREEK

NORTH FORK SAN ONOFRE CREEK

SOUTH FORK SAN ONOFRE CREEK

BASILONE ROAD

IR SITE 1F

PULGAS ROAD

PULGAS CREEK

LAS PULGAS

ALISO CREEK

DE LUZ CREEK

O'NEILL LAKE

BACKFILL BORROW PIT

SANTA MARGARITA RIVER

BOULEVARD

VANDEGRIFT

WINDMILL LAKE

IR SITE 7 (CAMU) BOX CANYON LANDFILL

STUART MESA ROAD

SAN CLEMENTE

PACIFIC OCEAN

CITY OF OCEANSIDE

5

EXPLANATION:

- MAJOR AREA BOUNDARIES
- ROADS AND HIGHWAYS
- CREEKS AND STREAMS
- MCB CAMP PENDLETON BOUNDARY
- (53) OPERATION AREA DESIGNATION
- IR SITE 1F ■ REMEDIAL ACTION SITE LOCATION

SCALE
0 8000 16000 FEET

IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 1-2

REMEDIAL ACTION
SITE LOCATIONS

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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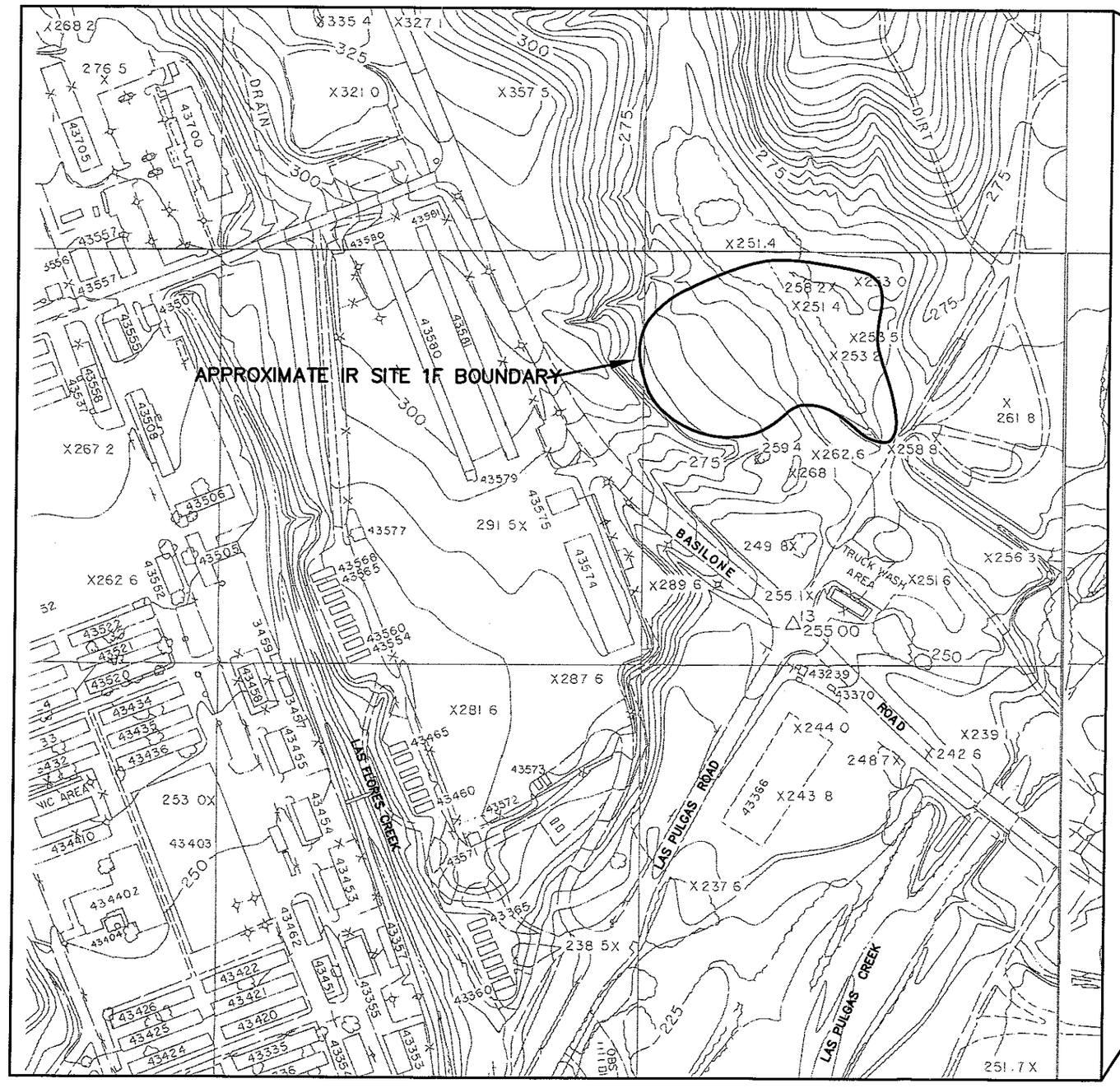

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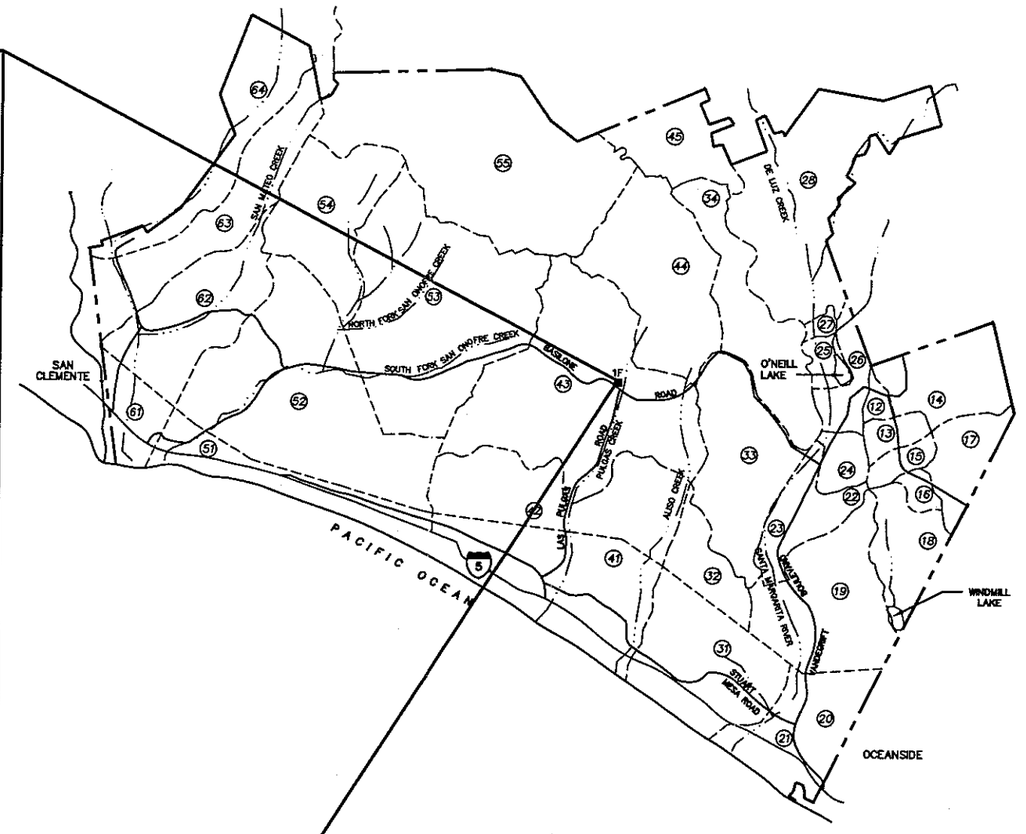

EXPLANATION:

- MAJOR AREA BOUNDARIES
- ROADS AND HIGHWAYS
- CREEKS AND STREAMS
- MCB CAMP PENDLETON BOUNDARY
- (53) OPERATION AREA DESIGNATION

IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 2-1

IR SITE 1F LOCATION MAP

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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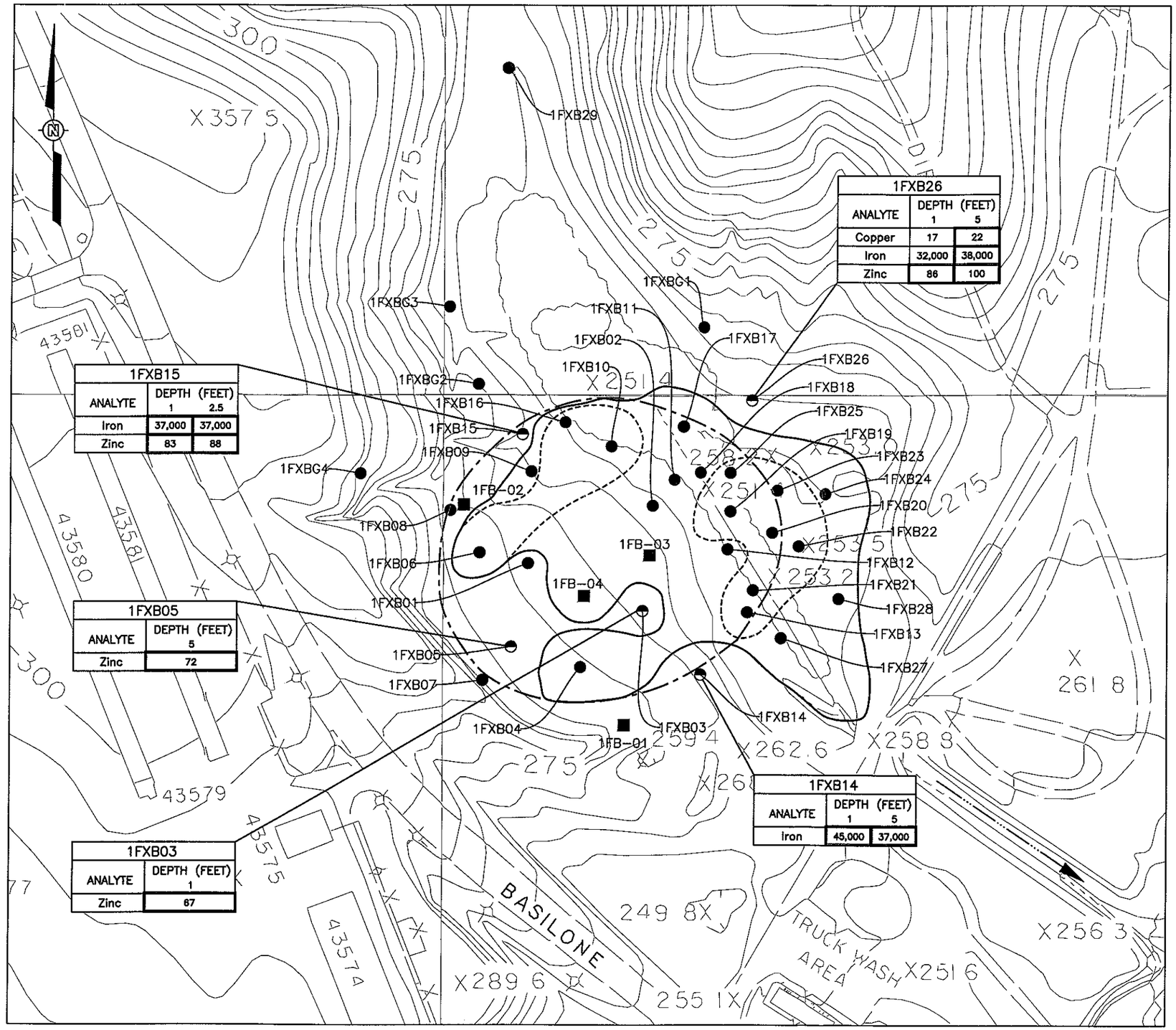


1FXB15		
ANALYTE	DEPTH (FEET) 1	2.5
Iron	37,000	37,000
Zinc	83	88

1FXB26		
ANALYTE	DEPTH (FEET) 1	5
Copper	17	22
Iron	32,000	38,000
Zinc	86	100

1FXB05	
ANALYTE	DEPTH (FEET) 5
Zinc	72

1FXB03	
ANALYTE	DEPTH (FEET) 1
Zinc	67

1FXB14		
ANALYTE	DEPTH (FEET) 1	5
Iron	45,000	37,000

EXPLANATION:

- 1FXB10 ● XRF BORING LOCATION
- 1FXB03 ◓ XRF BORING WITH SLIGHT EXCEEDANCE OF XRF – BASED COMPARISON LEVEL
- 1FB–03 ■ RI BORING LOCATION
- ——→ SURFACE–WATER FLOW DIRECTION
- SITE BOUNDARY – XRF
- ESTIMATED BOUNDARY IN OU3FS (MAY 1998)
- DEBRIS NOTED IN BORING LOGS

ANALYTE	XRF–BASED COMPARISON LEVEL (mg/kg)	FS REMEDIAL GOAL (mg/kg)
COPPER	20	28
IRON	34,500	37,000
ZINC	66	91

NOTES:

1. CONCENTRATIONS IN BORINGS WHICH SLIGHTLY EXCEEDED XRF–BASED COMPARISON LEVEL BUT WERE EXCLUDED FROM EXTENT OF SITE BOUNDARY ARE SHOWN. ONLY ANALYTES AND DEPTHS WITH EXCEEDANCES ARE SHOWN. BOLDED CELLS DENOTE CONCENTRATIONS THAT EXCEED XRF–BASED COMPARISON LEVEL.
2. XRF – X–RAY FLUORESCENCE

TOPOGRAPHIC REFERENCE:

MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 36B, 36D, AND 37A.
DATE: DECEMBER 1987

SCALE
0 150 300 FEET

REFERENCE:
"ENERGY DISPERSIVE X–RAY FLUORESCENCE FIELD INVESTIGATION, SITES 1A, 1D, 1E, 1F, 2A AND 30, MARINE CORPS BASE CAMP PENDLETON, CALIFORNIA", PREPARED BY IT CORP.

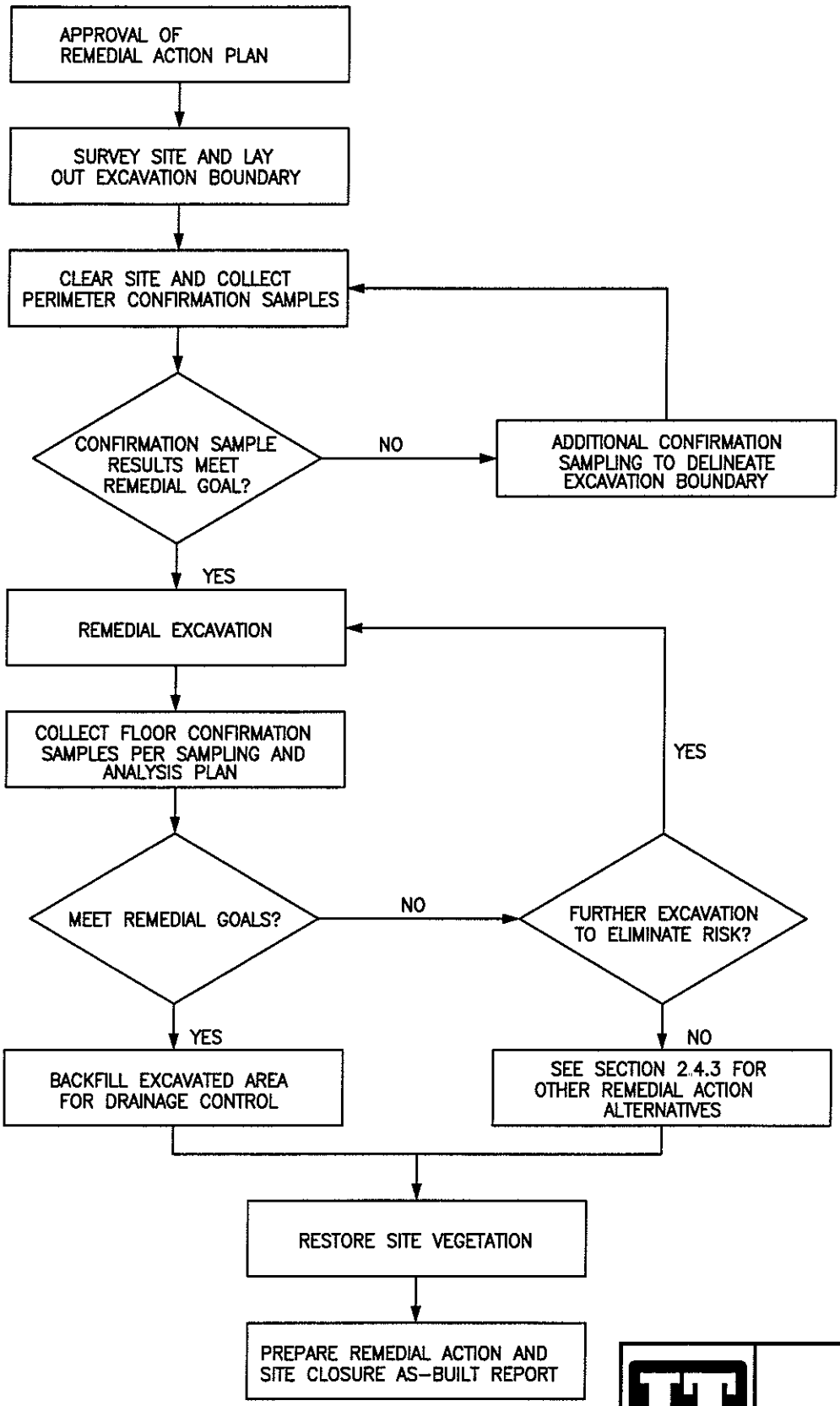
IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 2-2

ESTIMATED EXTENT OF CONTAMINATION
IR SITE 1F

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA



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CAMP PENDLETON, CALIFORNIA

FIGURE 2-3

REMEDIAL ACTION PROCESS DIAGRAM

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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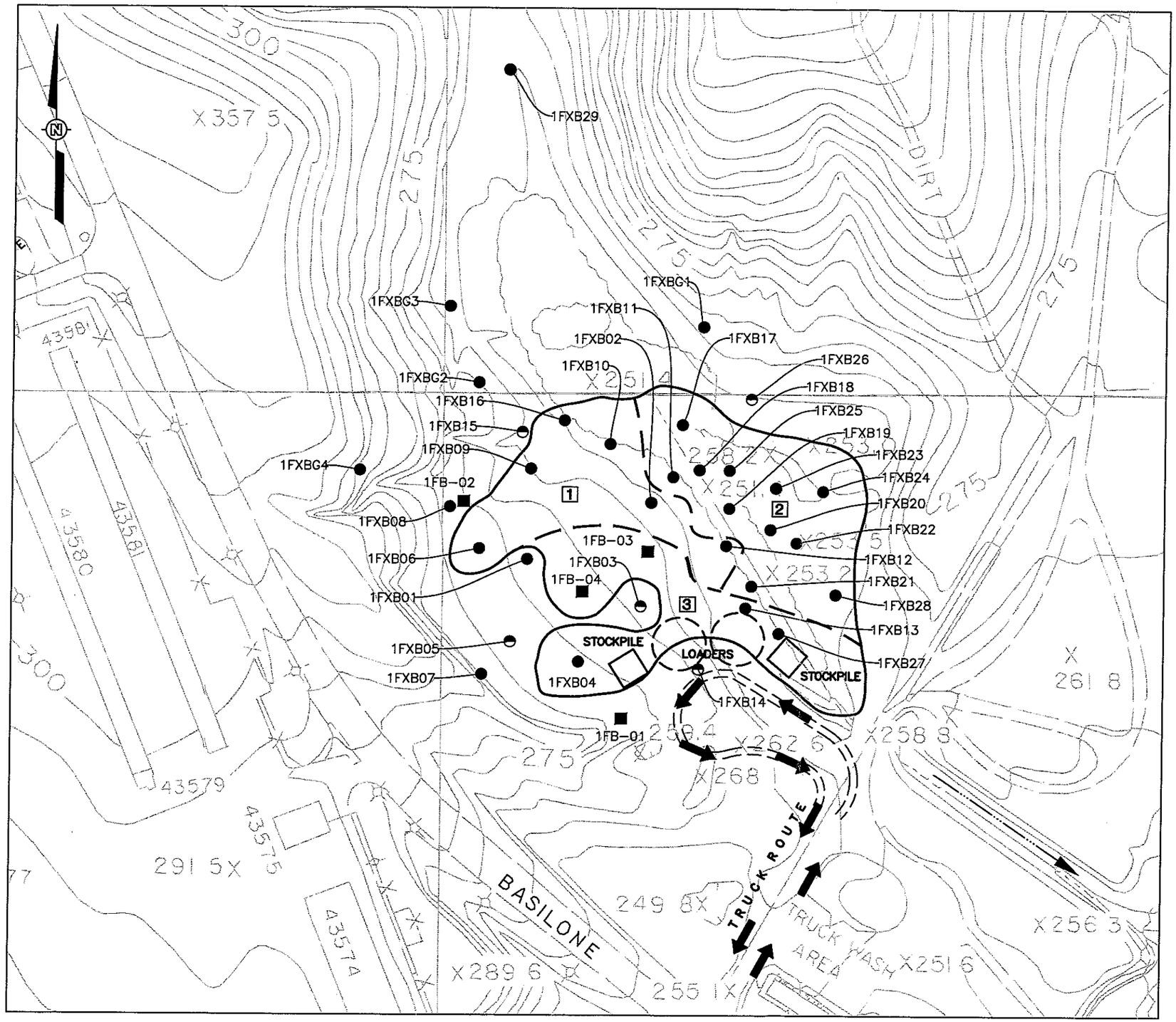
J. VASQUEZ	07/26/02



EXPLANATION:

1FXB10 ●	XRF BORING LOCATION
1FXB03 ◓	XRF BORING WITH SLIGHT EXCEEDANCE OF XRF – BASED COMPARISON LEVEL
1FB–03 ■	RI BORING LOCATION
➡	TRUCK ROUTE
——→	SURFACE–WATER FLOW DIRECTION
∿	EXCAVATION BOUNDARY
3 ∿	AREA BOUNDARY AND NUMBER

AREA NO.	AREA (FT.^{2})	PLANNED EXCAVATION DEPTH	ESTIMATED VOLUME (CY)
1	47,711	3	5,301
2	64,171	5	11,884
3	59,024	7	15,303
TOTAL	170,906		32,488

TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAPS 36B, 36D
AND 37A.
DATE: DECEMBER 1987

SCALE
0 150 300 FEET

REFERENCE:
"ENERGY DISPERSIVE X–RAY FLUORESCENCE FIELD INVESTIGATION, SITES 1A, 1D, 1E, 1F, 2A AND 30, MARINE CORPS BASE CAMP PENDLETON, CALIFORNIA", PREPARED BY IT CORP.

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FIGURE 2-4

PLANNED EXCAVATION BOUNDARY
IR SITE 1F

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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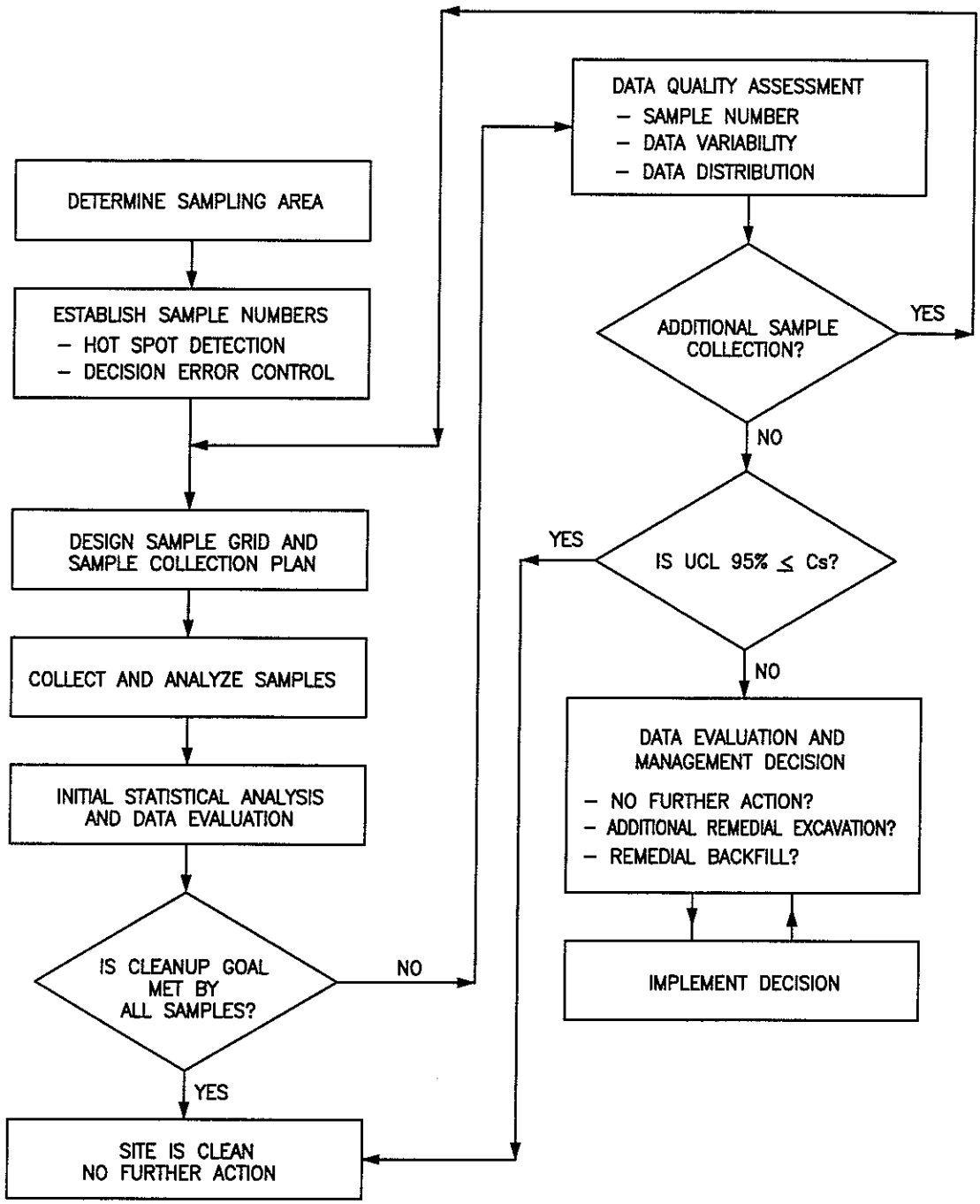

NOTE:
UCL 95% = UPPER 95% CONFIDENCE LIMIT OF MEAN
Cs = CLEANUP STANDARD

IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 2-5

CONFIRMATION SAMPLING DESIGN AND DATA EVALUATION PROCESS

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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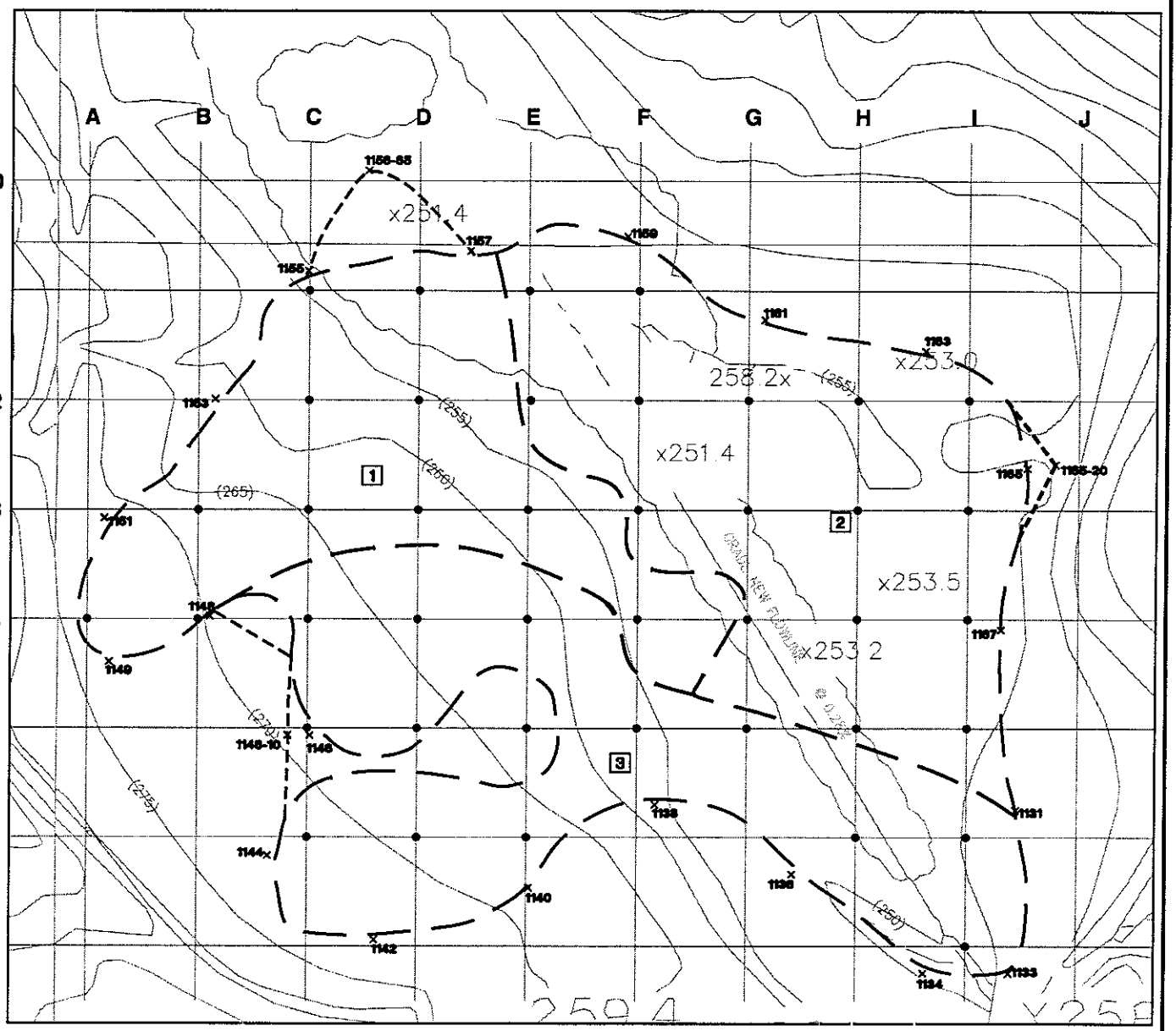

EXPLANATION:

- REVISED EXCAVATION BOUNDARY
- SITE BOUNDARY AND AREA NUMBER PER WORK PLAN
- FLOOR CONFIRMATION SAMPLING LOCATION
- 1133 × PERIMETER CONFIRMATION SAMPLE LOCATION
- —(255)— PREEXCAVATION CONTOUR

SCALE

0 100 200 FEET

IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 3-1

CONFIRMATION SAMPLING PLAN
IR SITE 1F

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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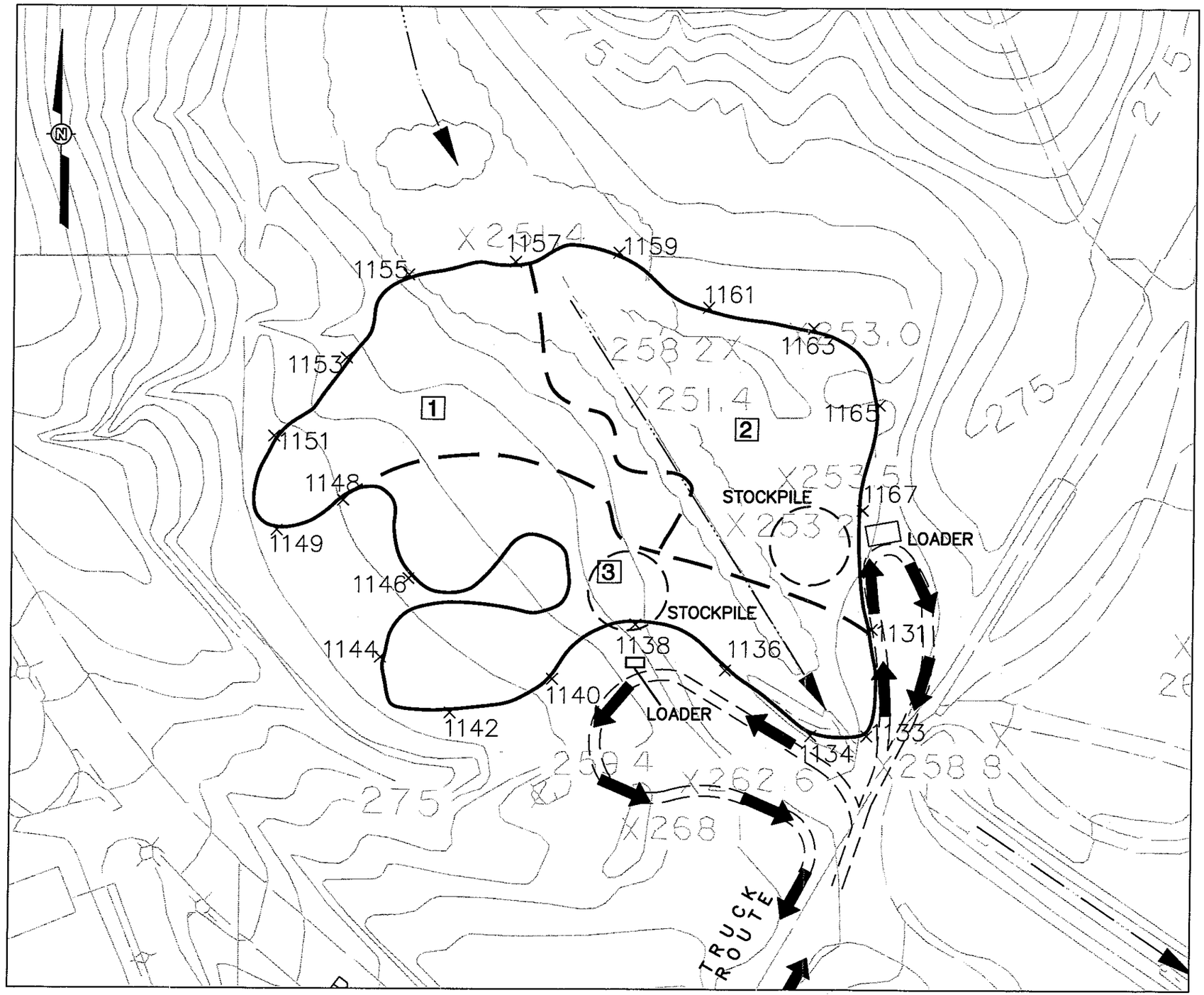

EXPLANATION:

1133 × PERIMETER SAMPLING LOCATION

TRUCK ROUTE

SURFACE–WATER FLOW DIRECTION

PLANNED EXCAVATION BOUNDARY

[3] AREA BOUNDARY AND NUMBER

AREA NO.	AREA ($FT.^2$)	PLANNED EXCAVATION DEPTH	ESTIMATED VOLUME (CY)
1	47,711	3	5,301
2	64,171	5	11,884
3	59,024	7	15,303
TOTAL	170,906		32,488

TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAPS 36B, 36D
AND 37A.
DATE: DECEMBER 1987

SCALE
0 100 200 FEET

REFERENCE:
"ENERGY DISPERSIVE X–RAY FLUORESCENCE FIELD INVESTIGATION, SITES 1A, 1D, 1E, 1F, 2A AND 30, MARINE CORPS BASE CAMP PENDLETON, CALIFORNIA", PREPARED BY IT CORP.

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CAMP PENDLETON, CALIFORNIA

FIGURE 3-2
SITE PLAN AND
PLANNED EXCAVATION BOUNDARY
IR SITE 1F
MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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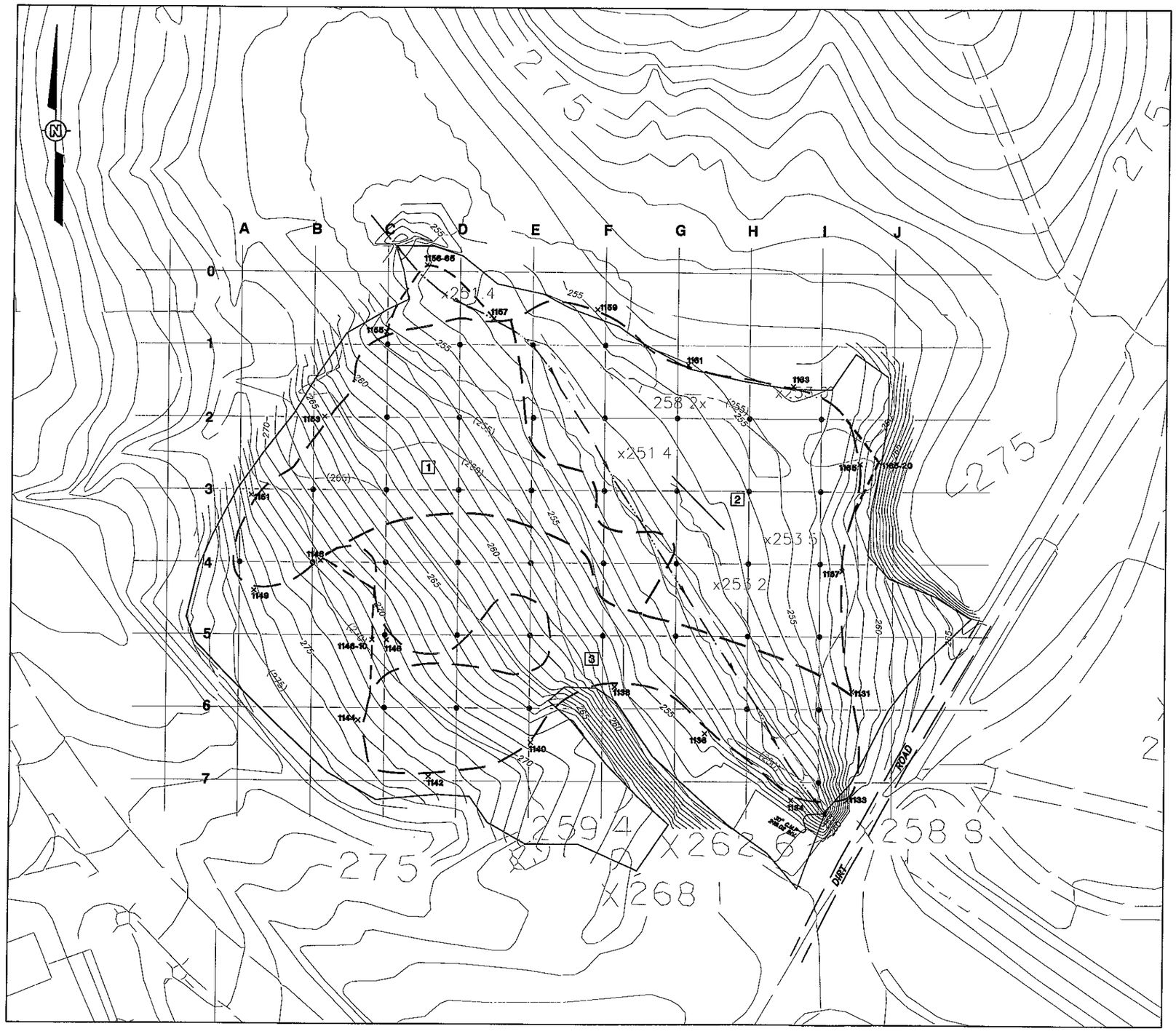
DRAWN BY	J. VASQUEZ 07/26/02



EXPLANATION:

- REVISED EXCAVATION BOUNDARY
- 1 — EXCAVATION PLAN PER WORK PLAN
- A / 1 — FLOOR CONFIRMATION SAMPLING LOCATION
- 1133 × — PERIMETER CONFIRMATION SAMPLE LOCATION
- —(255)— PREEXCAVATION CONTOUR
- — 255 — FINAL SITE GRADE
- BACKFILL BOUNDARY

FINAL SITE GRADE SURVEY BY TOWILL INC.
DATE: 7/22/02

SCALE
0 150 300 FEET

IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 3-3

FINAL SITE GRADE AS-BUILT CONDITIONS
IR SITE 1F

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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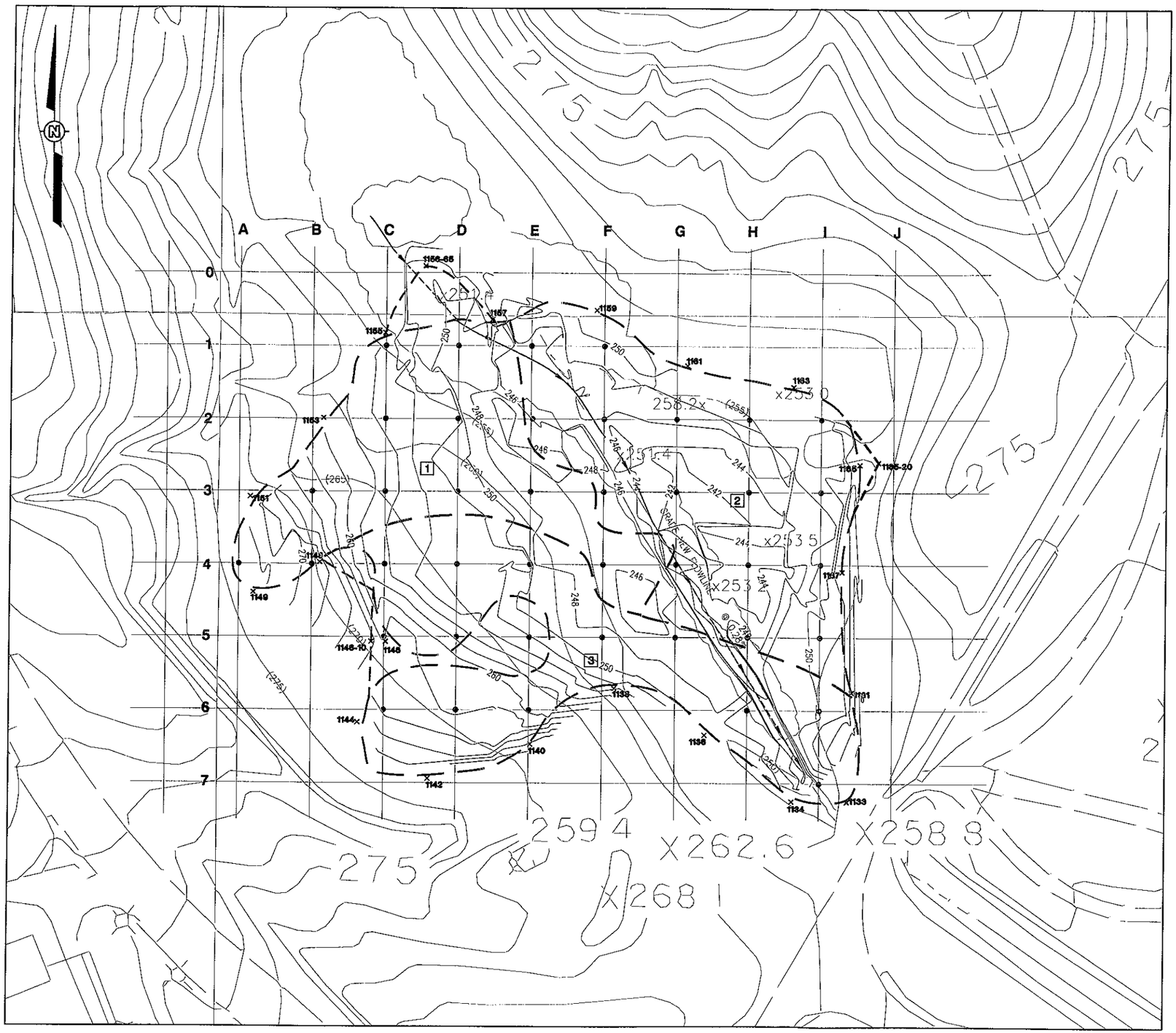

EXPLANATION:

- REVISED EXCAVATION BOUNDARY
- 1 — SITE BOUNDARY AND AREA NUMBER PER WORK PLAN
- A / 1 — FLOOR CONFIRMATION SAMPLING LOCATION
- 1133 × — PERIMETER CONFIRMATION SAMPLE LOCATION
- —(255)— PREEXCAVATION CONTOUR
- — 255 — POSTEXCAVATION CONTOUR

POSTEXCAVATION SURVEY BY CALVADA SURVEYING INC.
DATE: 9/27/99

SCALE
0 150 300 FEET

IT CORPORATION

EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 4-1

POSTEXCAVATION AS-BUILT CONDITIONS
IR SITE 1F

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

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TABLES

Table 2-1
Remediation Standards for Soil at IR Site 1F

COCs	Maximum Concentration in RI/FS[a] (mg/kg)	Remediation Standard, 0 to 5 Feet Below Ground Surface (mg/kg)	Basis[a,b]	Remediation Standard, 5 to 10 Feet Below Ground Surface (mg/kg)	Basis[a,c]
Antimony	61	8.8	Background	30[d]	PRG[d]
Arsenic	12	4.3	Background	4.3	Background
Copper	12,500	28	Background	2,800	PRG
Iron	129,000	37,000	Background	--	--
Lead	1,260	15	Background	130	PRG
Zinc	7,390	91	Background	--	--

[a] *Source: Marine Corps Base Camp Pendleton, California, Record of Decision, Operable Unit 3, Final (SWDIV, 1999a)*

[b] *Goal is noted as either PRG, PLE, or background, whichever is the basis for the goal for 0 to 5 feet below ground surface.*

[c] *Goal is noted as either PRG, PLE, or background, whichever is the basis for the goal for 5 to 10 feet below ground surface.*

[d] *Remediation standard in soil was set at a level estimated to be protective of groundwater.*

-- Indicates that compound is not a remediation contaminant of concern at that depth interval

COCs - chemicals of concern

mg/kg - milligrams per kilogram

PLE - preliminary limit of exposure

PRG - preliminary remediation goal

RI/FS - remedial investigation/feasibility study

Table 3-1
Summary of Initial Perimeter (Wall) Confirmation Sampling Results

Analyte				Remediation Standard[a]													
Cleanup Standards		0 to 5 feet		Antimony 8 8 (B)		Arsenic 4 3 (B)		Copper 28 (B)		Iron 37,000 (B)		Lead 15 (B)		Zinc 91 (B)	
		5 to 10 feet		30 (PRG)		4 3 (B)		2,800 (PRG)		--		130 (PRG)		--	
Unit				(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
Sample Identifier	Sample Location Number	Sample Depth (feet)	Date Collected												
19739-078	Site 1F-1131	2.0	12/9/1998	0.43	U	4.50	X	30.3	X	22,600		3.4		33.3	
19739-076	Site 1F-1133	3.0	12/9/1998	0.42	U	3.80		25.2		20,600		9.8		70.1	
19739-114	Site 1F-1134	3.0	12/9/1998	0.41	U	6.40	X	22.8		15,500		2.0		23.6	
19739-111	Site 1F-1136	3.0	12/10/1998	0.42	U	3.90		36.8	X	19,600		27.8	X	66.9	
19739-110	Site 1F-1138	3.0	12/10/1998	0.43	U	3.30		26.2		17,100		18.0	X	111.0	X
19739-108	Site 1F-1140	3.0	12/10/1998	0.42	U	3.10		10.8		16,200		3.0		13.5	
19739-104	Site 1F-1142	3.0	12/10/1998	0.41	U	0.43	J	2.5	U	3,450		0.8	J	7.0	
19739-102	Site 1F-1144	3.0	12/10/1998	0.45	U	1.40		7.7		12,800		3.4		26.4	
19739-099	Site 1F-1148	3.0	12/10/1998	0.45	J	3.00		5.6	U	10,900		4.6		14.9	
19739-098	Site 1F-1149	3.0	12/10/1998	0.43	U	1.00	J	3.8	U	6,430		3.7		16.4	
19739-096	Site 1F-1151	3.0	12/10/1998	0.48	U	0.38	J	2.9	U	4,360		2.3		13.5	
19739-095	Site 1F-1153	3.0	12/10/1998	0.42	U	2.70		4.0	U	8,670		3.3		16.6	
19739-092	Site 1F-1155	3.0	12/10/1998	0.43	U	3.20		8.2		14,000		4.9		21.8	
19739-093	Site 1F-1157[b]	3.0	12/10/1998	0.44	U	11.50	X	27.2	X	20,250		8.2		42.8	
19739-090	Site 1F-1159	2.0	12/10/1998	0.42	U	1.30	U	3.3	U	11,600		6.3		42.9	
19739-088	Site 1F-1161	2.0	12/9/1998	0.43	U	1.20	U	56.8	X	13,200		3.8		41.7	
19739-086	Site 1F-1163	2.0	12/9/1998	0.42	U	5.40	X	25.5		19,800		2.8		32.1	
19739-297	Site 1F-1165	2.5	12/9/1998	2.70	J	3.70		100.0	x	22,300		57.8	x	475.0	x
19739-081	Site 1F-1167	2.0	12/9/1998	0.45	U	7.30	X	32.7	X	24,400		3.6		38.2	

[a] Cleanup standards are based on background (B) or the preliminary remediation goal (PRG).

[b] Average of the original sample and field duplicate sample results.

X - Result exceeds the 0- to 5-foot cleanup standard

U - Not detected above or equal to the stated reporting limit

J - Analyte detected at the reported concentration with uncertainty.

mg/kg - milligrams per kilogram.

Table 3-2
Summary of Floor Confirmation Sampling Results at Planned Excavation Depth

Analyte					Remediation Standard[a]					
Cleanup Standard			0 to 5 feet 5 to 10 feet		Antimony 8.8 (B) 30 (PRG)	Arsenic 4.3 (B) 4.3 (B)	Copper 28 (B) 2,800 (PRG)	Iron 37,000 (B) --	Lead 15 (B) 130 (PRG)	Zinc 91(B) --
Unit					(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Sample Identifier	Grid Location	Sample Location Number	Sample Depth (feet)	Date Collect						
19739-321	A4	1FA4-01	3.5	7/19/1999	3.90	0.37 U	4.2 U	8,210	6.9	27.6
19739-317	B3	1FB3-02	5.0	7/19/1999	5.40	1.50	72.2 X	14,400	45.6 X	449.0 X
19739-318	B4	1FB4-01	3.5	7/19/1999	0.82 U	1.60 U	7.0 U	7,130	12.5	31.0
19739-330	C1	1FC1-01	3.5	7/19/1999	3.00 U	1.20 U	6.8 U	11,500	3.3	17.2
19739-406	C2	1FC2-01	3.5	7/22/1999	0.37 U	0.61 J	2.7	16,400	2.7	50.4
19739-323	C3	1FC3-01	3.5	7/19/1999	68.8 X	12.00 X	2,840.0 X	96,600 X	1,600.0 X	8,650.0 X
19739-320	C4	1FC4-01	7.5	7/19/1999	3.10	3.40	318.0 X	19,300	222.0 X	2,380.0 X
19739-337	C6	1FC6-02	9.0	7/19/1999	0.42 U	1.70 U	5.1 U	7,090	13.3	35.5
19739-328	D1	1FD1-02	9.0	7/19/1999	0.41 U	3.50	23.4	28,200	6.8	88.2
19739-324	D2	1FD2-01	3.5	7/19/1999	11.50 X	5.00 X	322.0 X	26,000	364.0 X	2,080.0 X
19739-325	D3	1FD3-01	3.5	7/19/1999	26.30 X	10.10 X	4,200.0 X	109,000 X	967.0 X	5,290.0 X
19739-326	D4	1FD4-01	3.5	7/19/1999	87.50 X	20.40 X	6,230.0 X	112,000 X	1,720.0 X	11,000.0 X
19739-329	D5	1FD5-01	7.5	7/19/1999	28.60 X	13.60 X	2,170.0 X	123,000 X	912.0 X	6,980.0 X
19739-334	D6	1FD6-02	9.0	7/19/1999	0.40 U	1.70	5.1	21,300	5.1	65.4
19739-396	E1	1FE1-01	5.5	7/22/1999	0.73	3.70	35.6 X	27,600	9.3	85.1
19739-358	E2	1FE2-01	5.5	7/20/1999	0.56	4.10	43.5 X	34,000	34.6 X	87.0
19739-359	E3	1FE3-01	5.5	7/20/1999	34.30 X	10.00 X	968.0 X	118,000 X	1,160.0 X	3,160.0 X
19739-361	E4	1FE4-01	3.5	7/20/1999	11.80 X	10.90 X	4,310.0 X	263,000 X	861.0 X	2,290.0 X
19739-376	E5	1FE5-01	7.5	7/21/1999	15.80 X	11.40 X	4,070.0 X	64,200 X	748.0 X	3,020.0 X
19739-407	E6	1FE6-01	7.5	7/22/1999	0.45	2.90	7.7	19,000	5.4	38.6
19739-339	F1	1FF1-01	7.5	7/20/1999	0.42 U	2.40	12.4	20,400	9.9	103.0 X
19739-382	F2	1FF2-02	7.0	7/21/1999	0.57 U	3.80	41.0 X	31,600	10.0	94.3 X
19739-402	F3	1FF3-02	7.0	7/22/1999	0.58 U	5.60 X	38.2 X	29,400	12.0	120.0 X
19739-360	F4	1FF4-01	5.5	7/20/1999	0.39	4.10	30.7 X	24,400	9.3	414.0 X
19739-375	F5	1FF5-02	5.0	7/21/1999	8.40	6.70 X	216.0 X	54,100 X	231.0 X	1,290.0 X
19739-342	G2	1FG2-02	9.0	7/20/1999	0.45 U	4.30	49.7 X	36,100	7.3	101.0 X
19739-348	G3	1FG3-02	7.0	7/20/1999	0.47 U	4.30	44.9 X	36,000	9.7	115.0 X
19739-384	G4	1FG4-02	7.0	7/21/1999	0.36 U	15.40 X	97.5 X	47,500 X	7.7	92.3 X
19739-379	G5	1FG5-02	7.0	7/21/1999	0.46 U	4.50 X	9.6	14,400	2.2 U	13.5
19739-343	H2	1FH2-01	7.5	7/20/1999	0.38 U	3.50	26.1	18,400	2.3	39.0
19739-351	H3	1FH3-02	7.0	7/20/1999	0.43 U	3.00	51.3 X	34,300	11.1	85.2
19739-353	H4	1FH4-02	7.0	7/20/1999	0.38 U	8.00 X	46.3 X	33,400	1.0 J	53.1
19739-405	H5	1FH5-02	9.0	7/22/1999	0.49 U	6.90 X	32.7 X	23,700	2.8	27.1
19739-388	H6	1FH6-02	7.5	7/22/1999	0.36	4.30	29.3 X	20,700	1.9	32.3
19739-346	I2	1FI2-02	9.0	7/20/1999	2.50	0.62 J	9.7	5,120	23.6 X	37.1
19739-357	I3	1FI3-02	7.0	7/20/1999	0.50	5.00 X	102.0 X	25,400	21.8 X	104.0 X
19739-355	I4	1FI4-02	7.0	7/20/1999	0.36 U	3.30	29.2 X	19,700	0.9 J	32.2
19739-393	I5	1FI5-01	5.5	7/22/1999	0.35 U	4.40 X	23.9	22,300	2.0	27.3
19739-399	I6	1FI6-01	7.5	7/22/1999	0.36 U	4.20	19.7	19,100	1.2 U	22.0
19739-392	I7	1FI7-02	9.0	7/22/1999	0.27 U	2.50	14.0	11,800	1.2 J	18.4

[a] *Cleanup standards are based on background (B) or the preliminary remediation goal (PRG)*

X - Result exceeds the 0- to 5-foot cleanup standard

J - Analyte detected at the reported concentration with uncertainty

U - Not detected above or equal to the stated reporting limit

mg/kg - milligrams per kilogram

Table 3-3
Summary of Floor Confirmation Sampling Results at Overexcavation Depth

Analyte / Cleanup Standard / Unit			0 to 5 feet / 5 to 10 feet		Remediation Standard[a]					
					Antimony 8 8 (B) 30 (PRG) (mg/kg)	Arsenic 4 3 (B) 4 3 (B) (mg/kg)	Copper 28 (B) 2 800 (PRG) (mg/kg)	Iron 37 000 (B) -- (mg/kg)	Lead 15 (B) 130 (PRG) (mg/kg)	Zinc 91 (B) -- (mg/kg)
Sample Identifier	Grid Location	Sample Location Number	Sample Depth (feet)	Date Collect						
19739-321	A4	1FA4-01	3.5	7/19/1999	3.90	0.37 U	4.2 U	8,210	6.9	27.6
19739-508	B3	1FB3-03	6.2	8/12/1999	1.70	1.30	27.9	8,290	29.8 X	146.0 X
19739-318	B4	1FB4-01	3.5	7/19/1999	0.82 U	1.60 U	7.0 U	7,130	12.5	31.0
19739-330	C1	1FC1-01	3.5	7/19/1999	3.00 U	1.20 U	6.8 U	11,500	3.3	17.2
19739-406	C2	1FC2-01	3.5	7/22/1999	0.37 U	0.61 J	2.7	16,400	2.7	50.4
19739-452	C3	1FC3-02	9.6	8/2/1999	0.59 U	3.10	12.8	16,000	7.9	22.1
19739-449	C4	1FC4-02	13.2	8/2/1999	0.39 U	0.60 J	7.9	4,730	6.3	31.4
19739-505	C5	1FC5-01	7.5	8/12/1999	0.32 U	2.10	15.2	17,000	15.3 X	142.0 X
19739-337	C6	1FC6-02	9.0	7/19/1999	0.42 U	1.70 U	5.1 U	7,090	13.3	35.5
19739-328	D1	1FD1-02	5.0	7/19/1999	0.41 U	3.50	23.4	28,200	6.8	88.2
19739-460	D2	1FD2-02	6.7	8/2/1999	0.39 U	2.60	24.5	16,900	5.4	52.2
19739-458	D3	1FD3-02	11.5	8/2/1999	0.43 U	2.00	17.3	14,500	10.3	59.1
19739-454	D4	1FD4-02	12.6	8/2/1999	0.37 U	1.10 J	7.9	7,260	3.3	14.3
19739-503	D5	1FD5-02	9.2	8/12/1999	0.40 U	4.30	21.6	24,900	12.9	71.9
19739-334	D6	1FD6-02	9.0	7/19/1999	0.52 U	1.70 U	5.1	21,300	5.1	65.4
19739-396	E1	1FE1-01	5.5	7/22/1999	0.73	3.70	35.6 X	27,600	9.3	85.1
19739-542	E2	1FE2-02	6.9	8/16/1999	2.20	3.70	29.5 X	31,500	135.0 X	62.9
19739-456	E3	1FE3-02	13.4	8/2/1999	0.48 U	2.00	25.4	19,200	8.1	79.7
19739-511	E4	1FE4-02	11.9	8/12/1999	0.31 U	4.00	7.2	22,900	5.8	25.7
19739-501	E5	1FE5-03	15.9	8/12/1999	0.29 U	0.23 U	7.1	6,280	2.4	12.5
19739-407	E6	1FE6-01	7.5	7/22/1999	0.45 U	2.90	7.7	19,000	5.4	38.6
19739-339	F1	1FF1-01	5.5	7/20/1999	0.42 U	2.40	12.4	20,400	9.9	103.0 X
19739-382	F2	1FF2-02	7.0	7/21/1999	0.57 U	3.80	41.0 X	31,600	10.0	94.3 X
19739-402	F3	1FF3-02	7.0	7/22/1999	0.58 U	5.60 X	38.2 X	29,400	12.0	120.0 X
19739-517	F4	1FF4-02	7.6	8/12/1999	0.34 U	4.00	50.2 X	31,900	8.8	93.2 X
19739-499	F5	1FF5-03	9.3	8/12/1999	0.38 U	5.20 X	44.3 X	20,100	8.8	52.7
19739-342	G2	1FG2-02	7.0	7/20/1999	0.45 U	4.30	49.7 X	36,100	7.3	101.0 X
19739-515	G3	1FG3-04	12.1	8/12/1999	0.37 U	12.90 X	88.5 X	46,000 X	7.8	97.8 X
19739-572	G4	1FG4-03	8.0	8/23/1999	0.75 U	9.40 X	38.0 X	29,300	8.2	77.3
19739-379	G5	1FG5-02	9.0	7/21/1999	0.46 U	4.50 X	9.6	14,400	2.2 U	13.5
19739-343	H2	1FH2-01	5.5	7/20/1999	0.38 U	3.50	26.1	18,400	2.3	39.0
19739-513	H3	1FH3-03	10.5	8/12/1999	0.34 U	4.00	44.1 X	27,000	3.3	50.3
19739-540	H4	1FH4-03	10.4	8/16/1999	1.2	18.30 X	60.4 X	35,300	4.7	62.7
19739-405	H5	1FH5-02	9.0	7/22/1999	0.49 U	6.90 X	32.7 X	23,700	2.8	27.1
19739-388	H6	1FH6-02	7.5	7/22/1999	0.36 U	4.30	29.3 X	20,700	1.9	32.3
19739-532	I2	1FI2-03	9.4	8/16/1999	1.20 U	1.60	24.7	18,800	3.9	46.5
19739-535	I3	1FI3-03	9.4	8/16/1999	0.81 U	2.00	19.9	10,800	2.7	38.6
19739-538	I4	1FI4-03	9.0	8/16/1999	0.78	4.80 X	33.9 X	18,200	1.9	49.8
19739-393	I5	1FI5-01	5.5	7/22/1999	0.35 U	4.40 X	23.9	22,300	2.0	27.3
19739-399	I6	1FI6-01	7.5	7/22/1999	0.36 U	4.20	19.7	19,100	1.2 U	22.0
19739-392	I7	1FI7-02	9.0	7/22/1999	0.27 U	2.50	14.0	11,800	1.2 J	18.4

[a] Cleanup standards are based on background (B) or the preliminary remediation goal (PRG).

X - Result exceeds the 0- to 5-foot cleanup standard

J - Analyte detected at the reported concentration with uncertainty

U - Not detected above or equal to the stated reporting limit

mg/kg - milligrams per kilogram

Table 3-4
Summary of Daily Production in Waste Transportation

Date	Number of Trucks	Number of Loads	Volume Hauled to Site 7 (yd^3)	Accum Total Hauled (yd^3)	Comments
6/28/1999					Start of remedial excavation
6/30/1999	10	60	780	780	Waste hauling at IR Site 1F started
7/1/1999	14	106	1378	2158	
7/2/1999	15	80	1040	3198	Only hauled for 6 hours
7/6/1999	14	106	1378	4576	
7/7/1999	20	158	2054	6630	
7/8/1999	20	151	1963	8593	
7/9/1999	20	158	2054	10647	
7/12/1999	20	148	1924	12571	Also began hauling from IR Site 2A
7/13/1999	20	146	1898	14469	
7/14/1999	20	141	1833	16302	
7/15/1999	20	147	1911	18213	
7/16/1999	20	132	1716	19929	
7/19/1999	20	138	1794	21723	
7/20/1999	20	124	1612	23335	
7/21/1999	8	64	832	24167	
7/22/1999	9	63	819	24986	
7/23/1999	9	63	819	25805	
7/26/1999	9	62	806	26611	
7/27/1999	15	105	1365	27976	
7/28/1999	20	118	1534	29510	Began overexcavation - West
7/29/1999	20	124	1612	31122	
7/30/1999	25	146	1898	33020	
8/2/1999	19	125	1625	34645	
8/3/1999	20	134	1742	36387	
8/4/1999	20	131	1703	38090	
8/5/1999	12	83	1079	39169	
8/6/1999	12	82	1066	40235	
8/9/1999	13	91	1183	41418	
8/10/1999	9	9	117	41535	Only hauled 1 load per truck
8/11/1999	20	130	1690	43225	Began additional excavation - East
8/12/1999	20	136	1768	44993	
8/13/1999	20	139	1807	46800	
8/16/1999	20	130	1690	48490	
9/2/1999	10	41	533	49023	Began excavating creek
9/3/1999	9	38	494	49517	
9/7/1999	9	52	676	50193	
9/8/1999	9	63	819	51012	
9/9/1999	9	63	819	51831	
9/10/1999	9	63	819	52650	
9/13/1999	9	63	819	53469	
9/14/1999	9	63	819	54288	
9/15/1999	9	39	507	54795	
9/20/1999	9	35	455	55250	Excavation completed

Actual Volume Hauled to Site 7: 55,250 yd^3
Estimated Volume per Work Plan: 32 488 yd^3
(assume 13 in-place yd^3 per load using expansion of 1.2)

Actual Number of Loads: 4 250 loads
Estimated Number of Loads per Work Plan: 2 499 loads

yd^3 - cubic yards

Table 4-1
Summary of Final Sampling Depth

Sample Identifier	Grid Location	Sample Location Number	Planned Exc. Depth (feet)	Sample Elevation (feet)	Sample Depth Below PED (feet)	Actual Sample Depth (feet)	Date Collected
19739-321	A4	1FA4-01	3	272.9	0.5	3.5	7/19/1999
19739-508	B3	1FB3-03	3	263	3.2	6.2	8/12/1999
19739-318	B4	1FB4-01	3	268.7	0.5	3.5	7/19/1999
19739-330	C1	1FC1-01	3	254.5	0.5	3.5	7/19/1999
19739-406	C2	1FC2-01	3	255.4	0.5	3.5	7/22/1999
19739-452	C3	1FC3-02	3	256.4	6.6	9.6	8/2/1999
19739-449	C4	1FC4-02	7	255	6.2	13.2	8/2/1999
19739-505	C5	1FC5-01	7	263.3	0.5	7.5	8/12/1999
19739-337	C6	1FC6-02	7	265	2	9.0	7/19/1999
19739-328	D1	1FD1-02	3	248.8	2	5.0	7/19/1999
19739-460	D2	1FD2-02	3	251.4	3.7	6.7	8/2/1999
19739-458	D3	1FD3-02	3	251.4	8.5	11.5	8/2/1999
19739-454	D4	1FD4-02	7	252.6	5.6	12.6	8/2/1999
19739-503	D5	1FD5-02	7	258	2.2	9.2	8/12/1999
19739-334	D6	1FD6-02	7	261.3	2	9.0	7/19/1999
19739-396	E1	1FE1-01	5	246	5.5	5.5	7/22/1999
19739-543	E2	1FE2-03	5	246.8	3.4	8.4	8/16/1999
19739-456	E3	1FE3-02	3	248.3	10.4	13.4	8/2/1999
19739-511	E4	1FE4-02	7	252.2	4.9	11.9	8/12/1999
19739-501	E5	1FE5-03	7	251.2	8.9	15.9	8/12/1999
19739-407	E6	1FE6-01	7	259.5	7.5	7.5	7/22/1999
19739-339	F1	1FF1-01	5	249.2	0.5	5.5	7/20/1999
19739-382	F2	1FF2-02	5	245.7	7	7.0	7/21/1999
19739-402	F3	1FF3-02	5	247	7	7.0	7/22/1999
19739-517	F4	1FF4-02	3	246.8	4.6	7.6	8/12/1999
19739-499	F5	1FF5-03	7	247.8	2.3	9.3	8/12/1999
19739-342	G2	1FG2-02	5	247.4	2	7.0	7/20/1999
19739-667	G3	1FG3-05	5	239.9	9.8	14.8	9/16/1999
19739-572	G4	1FG4-03	5	241.2	8	8.0	8/23/1999
19739-379	G5	1FG5-02	7	246	2	9.0	7/21/1999
19739-343	H2	1FH2-01	5	249.7	0.5	5.5	7/20/1999
19739-513	H3	1FH3-03	5	244.4	5.5	10.5	8/12/1999
19739-541	H4	1FH4-04	5	243.4	6.9	11.9	8/16/1999
19739-405	H5	1FH5-02	5	247.1	9	9.0	7/22/1999
19739-388	H6	1FH6-02	7	248.6	7.5	7.5	7/22/1999
19739-532	I2	1FI2-03	5	248.8	4.4	9.4	8/16/1999
19739-535	I3	1FI3-03	5	247.4	4.4	9.4	8/16/1999
19739-538	I4	1FI4-03	5	248.3	4	9.0	8/16/1999
19739-393	I5	1FI5-01	5	251.7	5.5	5.5	7/22/1999
19739-399	I6	1FI6-01	7	252.7	7.5	7.5	7/22/1999
19739-392	I7	1FI7-02	7	246.7	9	9.0	7/22/1999
	Average Depth (feet)		5 15			8 43	

PED - planned excavation depth

Table 4-2
Summary of Final Perimeter (Wall) Confirmation Sampling Results

Analyte				Remediation Standard[a]													
Cleanup Standard		0 to 5 feet		Antimony		Arsenic		Copper		Iron		Lead		Zinc			
		5 to 10 feet		8.8 (B)		4.3 (B)		28 (B)		37,000 (B)		15 (B)		91 (B)			
Unit				30 (PRG)		4.3 (B)		2,800 (PRG)		--		130 (PRG)		--			
				(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)			
Sample Identifier	Sample Location Number	Sample Depth (feet)	Date Collected														
19739-078	Site 1F-1131	2.0	12/9/1998	0.43	U	4.50	X	30.3	X	22,600		3.4		33.3			
19739-076	Site 1F-1133	3.0	12/9/1998	0.42	U	3.80		25.2		20,600		9.8		70.1			
19739-114	Site 1F-1134	3.0	12/9/1998	0.41	U	6.40	X	22.8		15,500		2.0		23.6			
19739-111	Site 1F-1136	3.0	12/10/1998	0.42	U	3.90		36.8	X	19,600		27.8	X	66.9			
19739-110	Site 1F-1138	3.0	12/10/1998	0.43	U	3.30		26.2		17,100		18.0	X	111.0	X		
19739-108	Site 1F-1140	3.0	12/10/1998	0.42	U	3.10		10.8		16,200		3.0		13.5			
19739-104	Site 1F-1142	3.0	12/10/1998	0.41	U	0.43	J	2.5	U	3,450		0.8	U	7.0			
19739-102	Site 1F-1144	3.0	12/10/1998	0.45	U	1.40		7.7		12,800		3.4		26.4			
19739-563	Site 1F-1146-10	3.0	8/23/1999	0.59	U	0.73	J	3.8		6,680.0		3.1		16.5			
19739-099	Site 1F-1148	3.0	12/10/1998	0.45	J	3.00		5.6	U	10,900		4.6		14.9			
19739-098	Site 1F-1149	3.0	12/10/1998	0.43	U	1.00	J	3.8	U	6,430		3.7		16.4			
19739-096	Site 1F-1151	3.0	12/10/1998	0.48	U	0.38	J	2.9	U	4,360		2.3		13.5			
19739-095	Site 1F-1153	3.0	12/10/1998	0.42	U	2.70		4.0	U	8,670		3.3		16.6			
19739-092	Site 1F-1155	3.0	12/10/1998	0.43	U	3.20		8.2		14,000		4.9		21.8			
19739-666	Site 1F-1156-65	2.0	9/16/1999	22.00	U	2.70		20.8		13,800		34.3		60.5			
19739-093	Site 1F-1157[b]	3.0	12/10/1998	0.44	U	11.50	X	27.2		20,250		8.2		42.8			
19739-090	Site 1F-1159	2.0	12/10/1998	0.42	U	1.30	J	3.3	U	11,600		6.3		42.9			
19739-088	Site 1F-1161	2.0	12/9/1998	0.43	U	1.20	U	56.8	X	13,200		3.8		41.7			
19739-086	Site 1F-1163	2.0	12/9/1998	0.42	U	5.40	X	25.5		19,800		2.8		32.1			
19739-297	Site 1F-1165-20	2.5	7/2/1999	0.49	U	1.40		6.7		30,400		0.3	U	84.8			
19739-081	Site 1F-1167	2.0	12/9/1998	0.45	U	7.30	X	32.7	X	24,400		3.6		38.2			
			Average	1.47		3.27		17.31		14873.33		7.11		37.83			
			Standard Deviation	4.70		2.69		14.71		6929.66		8.86		27.11			
			Number of Samples	21		21		21		21		21		21			
			Student's t Distribution Value	1.729		1.729		1.729		1.729		1.729		1.729			
			UCL95%	**3.24**		**4.28**		**22.86**		**17487.89**		**10.46**		**48.06**			

[a] Cleanup standards are based on background (B) or the preliminary remediation goal (PRG)
[b] Average of the original sample and field duplicate sample results
X - Result exceeds the 0- to 5-foot cleanup standard
U - Not detected above or equal to the stated reporting limit
J - Analyte detected at the reported concentration with uncertainty
mg/kg - milligrams per kilogram
UCL95% - 95% upper confidence limit

Table 4-3
Summary of Final Floor Confirmation Sampling Results

Analyte						Remediation Standard[a]					
Cleanup Standard			0 to 5 feet			Antimony 8 8 (B)	Arsenic 4 3 (B)	Copper 28 (B)	Iron 37 000 (B)	Lead 15 (B)	Zinc 91 (B)
			5 to 10 feet			30 (PRG)	4 3 (B)	2 800 (PRG)	--	130 (PRG)	--
Unit						(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Sample Identifier	Grid Location	Sample Location Number	Planned Exc. Depth (feet)	Sample Depth (feet)	Date Collect						
19739-321	A4	1FA4-01	3	3.5	7/19/1999	3.90 U	0.37 U	4.2 U	8,210	6.9	27.6
19739-508	B3	1FB3-03	3	6.2	8/12/1999	1.70	1.30	27.9	8,290	29.8 X	146.0 X
19739-318	B4	1FB4-01	3	3.5	7/19/1999	0.82 U	1.60 U	7.0 U	7,130	12.5	31.0
19739-330	C1	1FC1-01	3	3.5	7/19/1999	3.00 U	1.20 U	6.8 U	11,500	3.3	17.2
19739-406	C2	1FC2-01	3	3.5	7/22/1999	0.37 U	0.61 J	2.7	16,400	2.7	50.4
19739-452	C3	1FC3-02	3	9.6	8/2/1999	0.59 U	3.10	12.8	16,000	7.9	22.1
19739-449	C4	1FC4-02	7	13.2	8/2/1999	0.39 U	0.60 J	7.9	4,730	6.3	31.4
19739-505	C5	1FC5-01	7	7.5	8/12/1999	0.32 U	2.10	15.2	17,000	15.3 X	142.0 X
19739-337	C6	1FC6-02	7	9.0	7/19/1999	0.42 U	1.70 U	5.1 U	7,090	13.3	35.5
19739-328	D1	1FD1-02	3	5.0	7/19/1999	0.41 U	3.50 U	23.4	28,200	6.8	88.2
19739-460	D2	1FD2-02	3	6.7	8/2/1999	0.39 U	2.60	24.5	16,900	5.4	52.2
19739-458	D3	1FD3-02	3	11.5	8/2/1999	0.43 U	2.00	17.3	14,500	10.3	59.1
19739-454	D4	1FD4-02	7	12.6	8/2/1999	0.37 U	1.10 J	7.9	7,260	3.3	14.3
19739-503	D5	1FD5-02	7	9.2	8/12/1999	0.30 U	4.30	21.6	24,900	12.9	71.9
19739-334	D6	1FD6-02	7	9.0	7/19/1999	0.40 U	1.70 U	5.1	21,300	5.1	65.4
19739-396	E1	1FE1-01	5	5.5	7/22/1999	0.73	3.70	35.6 X	27,600	9.3	85.1
19739-543	E2	1FE2-03	5	8.4	8/16/1999	0.64 U	3.70	14.9	21,200	3.3	26.7
19739-456	E3	1FE3-02	3	13.4	8/2/1999	0.48 U	2.00	25.4	19,200	8.1	79.7
19739-511	E4	1FE4-02	7	11.9	8/12/1999	0.31 U	4.00	7.2	22,900	5.8	25.7
19739-501	E5	1FE5-03	7	15.9	8/12/1999	0.29 U	0.23 U	7.1	6,280	2.4	12.5
19739-407	E6	1FE6-01	7	7.5	7/22/1999	0.45 U	2.90	7.7	19,000	5.4	38.6
19739-339	F1	1FF1-01	5	5.5	7/20/1999	0.42 U	2.40	12.4	20,400	9.9	103.0 X
19739-382	F2	1FF2-02	5	7.0	7/21/1999	0.57 U	3.80	41.0 X	31,600	10.0	94.3 X
19739-402	F3	1FF3-02	5	7.0	7/22/1999	0.58 U	5.60 X	38.2 X	29,400	12.0	120.0 X
19739-517	F4	1FF4-02	3	7.6	8/12/1999	0.34 U	4.00	50.2 X	31,900	8.8	93.2 X
19739-499	F5	1FF5-03	7	9.3	8/12/1999	0.38 U	5.20 X	44.3 X	20,100	8.8	52.7
19739-342	G2	1FG2-02	5	7.0	7/20/1999	0.45 U	4.30	49.7 X	36,100	7.3	101.0 X
19739-667	G3	1FG3-05	5	14.8	9/16/1999	26 U	2.90	9.7	15,800	4.9	40.7
19739-572	G4	1FG4-03	5	8.0	8/23/1999	0.75 U	9.40 X	38.0 X	29,300	8.2	77.3
19739-379	G5	1FG5-02	7	9.0	7/21/1999	0.46 U	4.50 X	9.6	14,400	2.2 U	13.5
19739-343	H2	1FH2-01	5	5.5	7/20/1999	0.38 U	3.50	26.1	18,400	2.3	39.0
19739-513	H3	1FH3-03	5	10.5	8/12/1999	0.34 U	4.00	44.1 X	27,000	3.3	50.3
19739-541	H4	1FH4-04	5	11.9	8/16/1999	0.65 U	5.30 X	25.5	19,800	0.84 J	28.1
19739-405	H5	1FH5-02	5	9.0	7/22/1999	0.49 U	6.90 X	32.7 X	23,700	2.8	27.1
19739-388	H6	1FH6-02	7	7.5	7/22/1999	0.36 U	4.30	29.3 X	20,700	1.9	32.3
19739-532	I2	1FI2-03	5	9.4	8/16/1999	1.20 U	1.60	24.7	18,800	3.9	46.5
19739-535	I3	1FI3-03	5	9.4	8/16/1999	0.81 U	2.00	19.9	10,800	2.7	38.6
19739-538	I4	1FI4-03	5	9.0	8/16/1999	0.78	4.80 X	33.9 X	18,200	1.9	49.8
19739-393	I5	1FI5-01	5	5.5	7/22/1999	0.35 U	4.40 X	23.9	22,300	2.0	27.3
19739-399	I6	1FI6-01	7	7.5	7/22/1999	0.36 U	4.20	19.7	19,100	1.2 U	22.0
19739-392	I7	1FI7-02	7	9.0	7/22/1999	0.27 U	2.50	14.0	11,800	1.2 J	18.4
		Average	5 15	8 43							
					Average	1 28	3 17	21 3	18663	6 6	53 6
					Standard Deviation	4.02	1.86	13.6	7777	5 3	35.0
					Number of Samples	41	41	41	41	41	41
					Student's t Distribution Value	1 684	1 684	1 684	1 684	1 684	1 684
					UCL95%	**2.34**	**3.66**	**24 9**	**20708**	**8.0**	**62.8**

[a] *Cleanup standards are based on background (B) or the preliminary remediation goal (PRG)*

X - Result exceeds the 0- to 5-foot cleanup standard

U - Not detected above or equal to the stated reporting limit

J - Analyte detected at the reported concentration with uncertainty

mg/kg - milligrams per kilogram

UCL - 95% upper confidence limit

APPENDIX A
PRECONSTRUCTION BIOLOGICAL SURVEY REPORT

MEC ANALYTICAL SYSTEMS, INC.

25 June 1999

Shane Austin
IT Corporation
3347 Michelson Drive, Suite 200
Irvine, CA 92612

Subject: Pre-construction site assessment of 1F and 2A for IT Group, Camp Pendleton

MEC Analytical Systems, Inc. (MEC) conducted a pre-construction biological review of two Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites on Marine Corps Base Camp Pendleton on 23 June 1999. The survey was conducted by MEC's wildlife biologist (Trisha Smith) and a biologist from Varanus Biological Services (Ingri Quon), who is qualified and permitted to survey California gnatcatcher, southwestern willow flycatcher, least Bell's vireo, California least tern, and arroyo toad.

The soil material is contaminated with heavy metals and other man-made wastes. The project calls for vegetation to be cleared and contaminated soil to be removed and then replaced with clean fill. Each former stockpile/dump site was less than four acres of recovering native upland vegetation with some wetland-associated species in low lying site areas. Our task was to assess several sites for any significant biological changes or new environmental concerns since the biological assessment was completed on 20 May 1999. In addition to the two sites that would be cleared and excavated immediately, we conducted a walk-through of Site 1A. This site is comprised of sage scrub, baccharis scrub, and willow scrub that will be cleared in the late summer.

Site 1F

Site 1F was burned in 1997 and again in the fall of 1998. Site vegetation was predominantly dense, exotic, invasive annuals that surround a central drainage ditch vegetated with young willows and mulefat. Several mature Mexican Elderberries (*Sambucus mexicana*) are growing just to the east of the drainage. One of the elderberry trees was the song perch of a solitary Yellow-breasted Chat (*Icteria virens*). The west edge of the site had several species of native annuals (for example, Canchalagua (*Centaurium venustrum*), Fascicled Tarwweed (*Hemizonia fasciculata*)) and bunch grasses emerging from sparsely populated compacted clay soil.

The site was approved for excavation on the day of the pre-construction biological review. Clearing began immediately following the walk-through. The equipment operator was told to avoid the native annuals as much as possible on the west edge of the site.

Photos of the site were taken prior to excavation.

2433 Impala Dr. Carlsbad, CA 92008
(760) 931-8081 FAX (760) 931-1580

6060 Corte del Cedro, Carlsbad, CA 92009
(760) 931-9225 FAX (760) 931-9251

98 Main St. Suite 428 Tiburon, CA 94920
(415) 435-1847 FAX (415) 435-0479

Site 2A
Site 2A was burned in 1997 On the day of the pre-construction screening the site was predominately vegetated with dried, exotic mustard, Deerweed (*Lotus scoparius*) and scattered, regenerating Laurel Sumac (*Malosma laurina*) The lower portion of the site was vegetated with sparse mulefat. Adjacent, surrounding vegetation was similar to on-site vegetation.

The site, staging area, temporary soil stockpile area, and equipment turn around area was biologically approved for project work on the day of the pre-construction biological screen. No rare or endangered species are expected at the site. Excavation of the site and use of the adjacent areas was to begin this week or early next week.

Photos of the site were taken prior to excavation.

Site 1A
Site 1A is vegetated with mature willows and broom baccharis (*Baccharis sarothroides*) and is located along the west side of a riparian corridor The adjacent, off-site upland vegetation to the west is mature coastal sage scrub To the east is exotic grassland, formerly coastal sage scrub, located on the east side of the riparian corridor

One Least Bell's vireo (a federally endangered species) and one Yellow-breasted chat (a California species of special concern) were detected within the work area of Site 1A A scolding, male California gnatcatcher (a federally threatened species) was detected just west of the site on the coastal sage scrub slope above work site Stake 1228.

This site will require a pre-construction biological screening prior to scheduled clearing/cleaning in mid-August or September We recommend clearing the work area in September following the departure of Least Bell's Vireo from the breeding grounds A biologist knowledgeable of Least Bell's Vireo breeding behavior and who is permitted to look for nests should assess the area prior to commencement of work if begun prior to 15 August. Also, if work is initiated at the site prior to 15 September there is the possibility of a "take" of occupied vireo habitat. This requires documentation by a biologist prior to the commencement of any work in the area

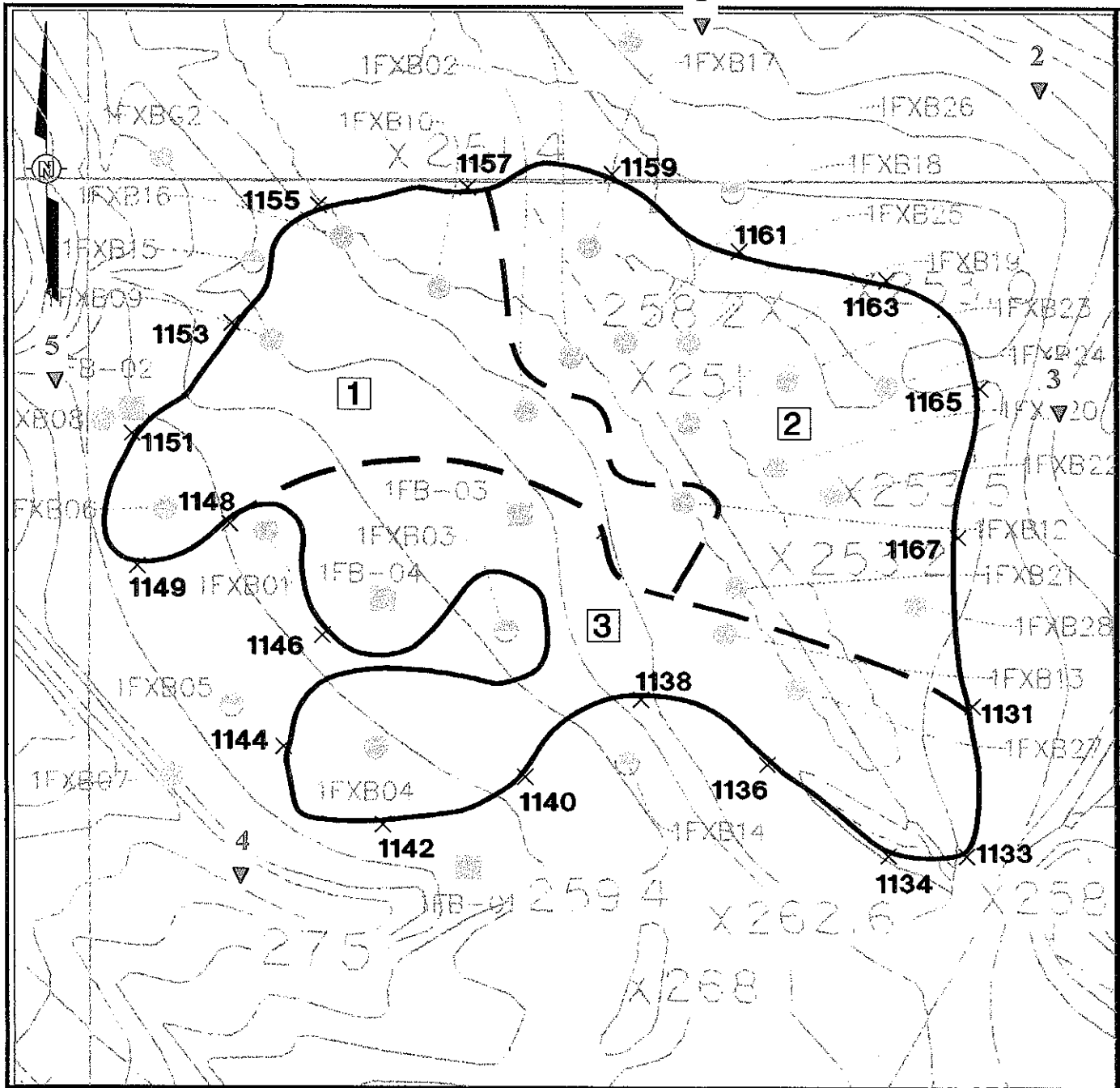
Please call me at (760) 931-8081 if you have any questions or concerns about the status of the designated work areas

Sincerely,

Karen Green

Karen Green
Project Manager and Biologist

APPENDIX B
PHOTOGRAPHS OF REMEDIAL CONSTRUCTION



6/17/99 11:54:25 L:\IT CORP\Miscellaneous\91738e.dwg

NOTES:

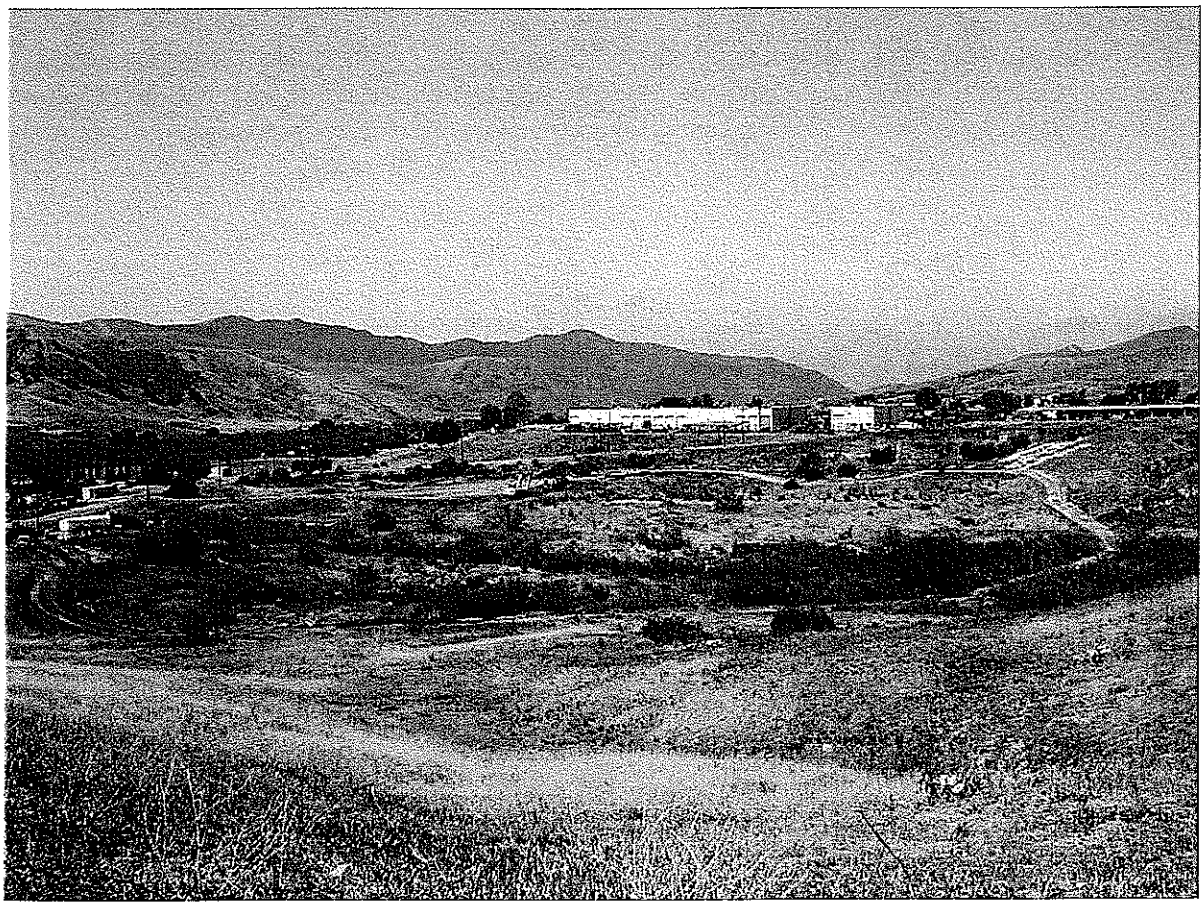
▼ - Photo Control Location (1-5)

OHM Remediation Services Corp.
A Subsidiary of OHM Corporation
SAN DIEGO, CA

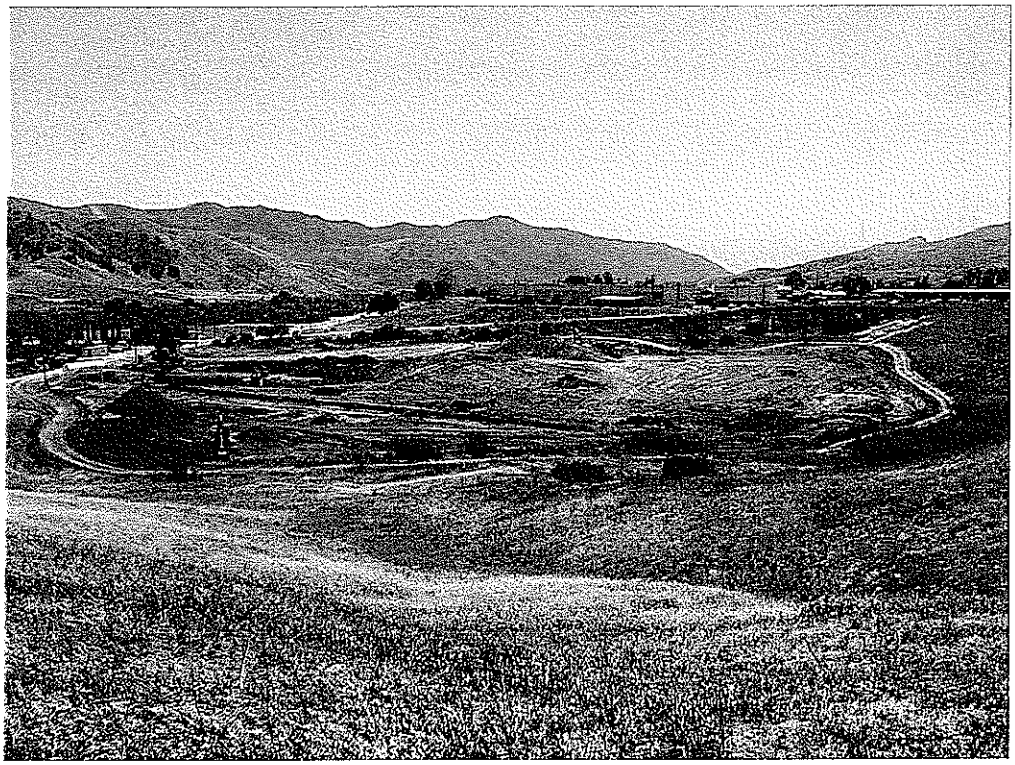
DATE	PREPARED BY	PROJECT NUMBER

REMEDIAL ACTION PROGRESS
SITE 1F
MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

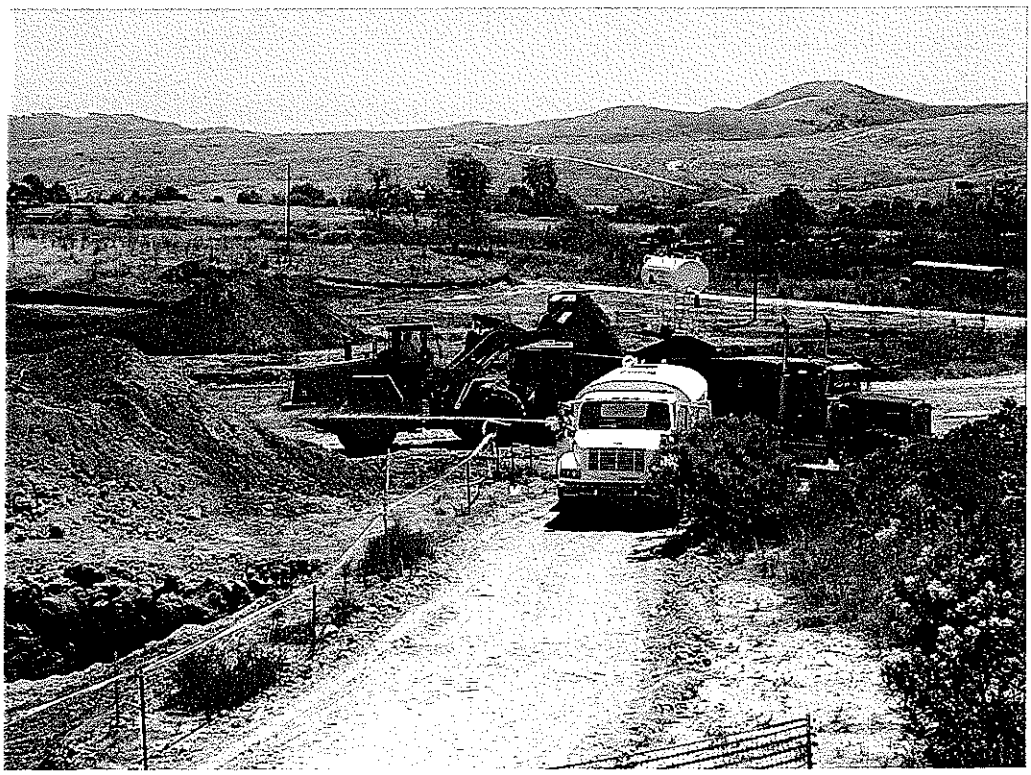
Photograph No. 1: Site 1F Before Soil Removal Activities (June 21, 1999)
Photo Control Location (PCL) #4



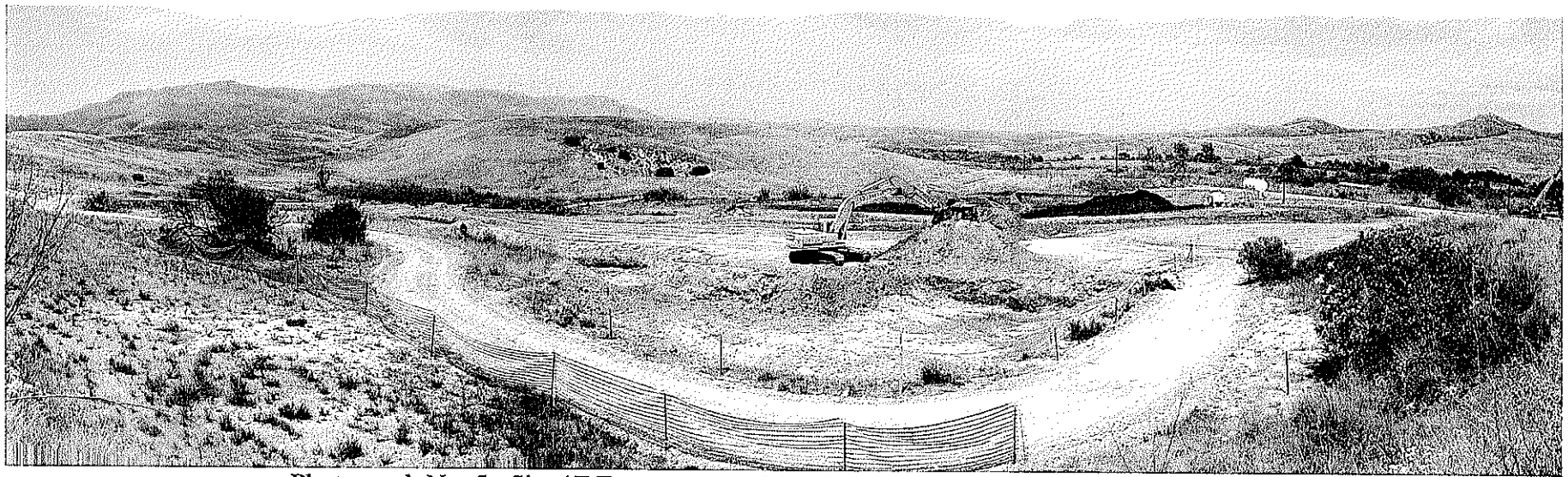
Photograph No. 2: Site 1F Prior to Clearing And Grubbing (June 25, 1999)
PCL # 1



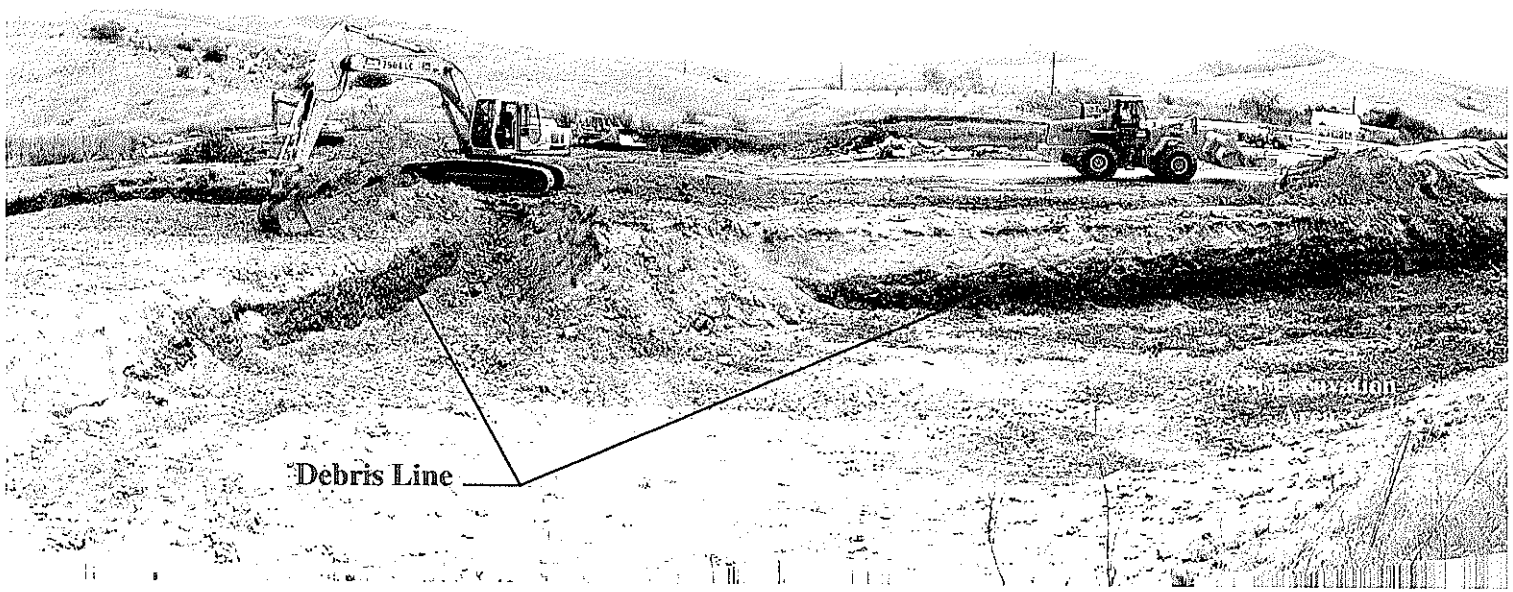
Photograph No. 3: Second Day of Excavating and Stockpiling Activities (June 29, 1999)
PCL # 1



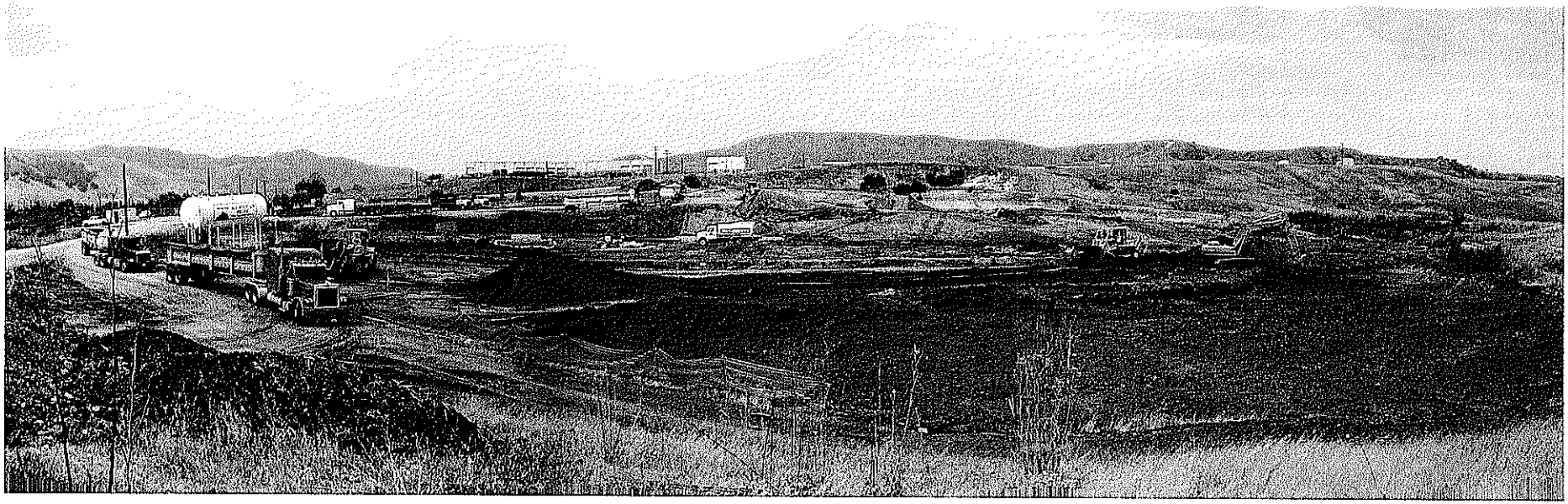
Photograph No. 4: First Day of Loading Contaminated Soil for Transport to CAMU (June 30, 1999)
PCL # 4



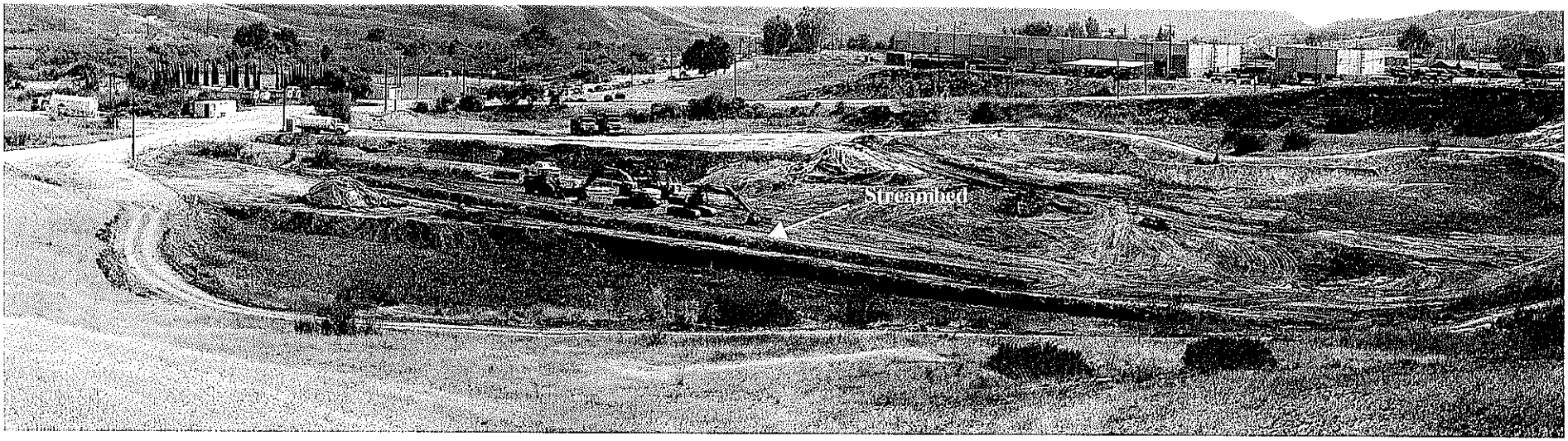
Photograph No. 5: Site 1F Excavating and Stockpiling Activities Western Area (July 7,199)
PCL # 4



Photograph No. 6: View of Debris Line Encountered Near Perimeter Location 1F-1147 (July 9, 1999)

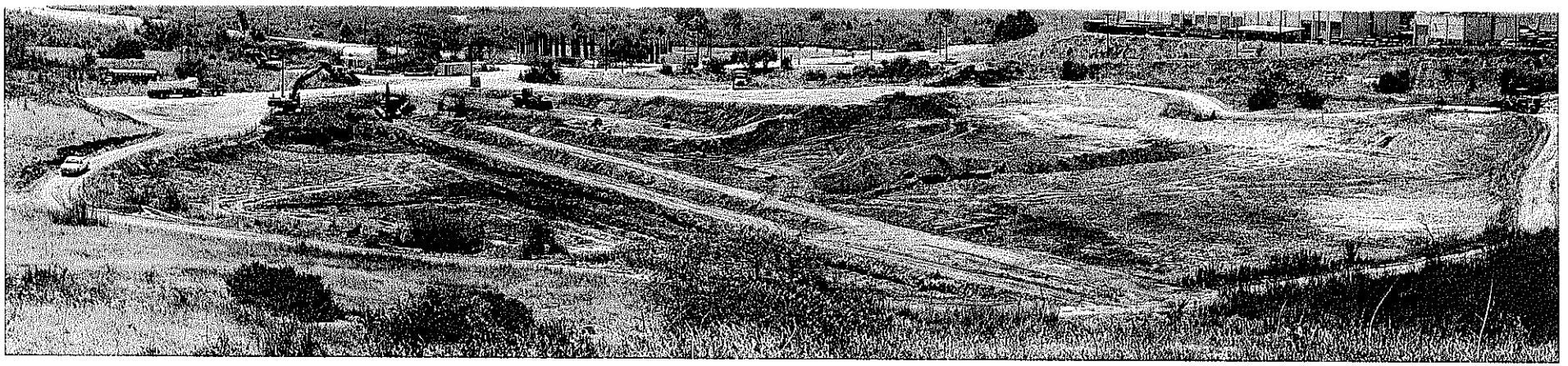


Photograph No. 7: Site 1F Remedial Activities Eastern Area (July 9, 1999)
PCL # 3

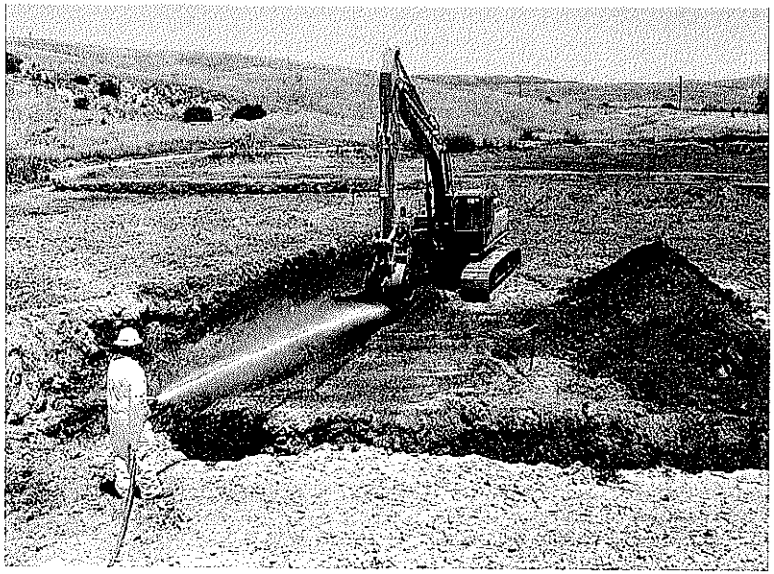


Photograph No. 8: Site 1F Remedial Activities in Progress (July 13, 1999)
PCL # 1

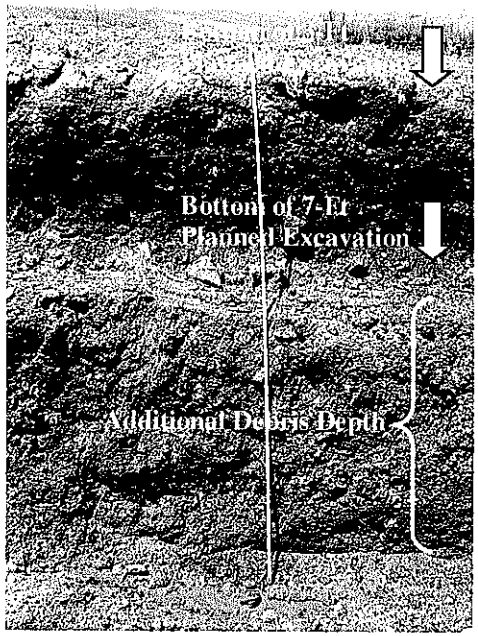
Photograph No. 9: Site 1F Remedial Activities in Progress (July 16, 1999)
PCL # 1



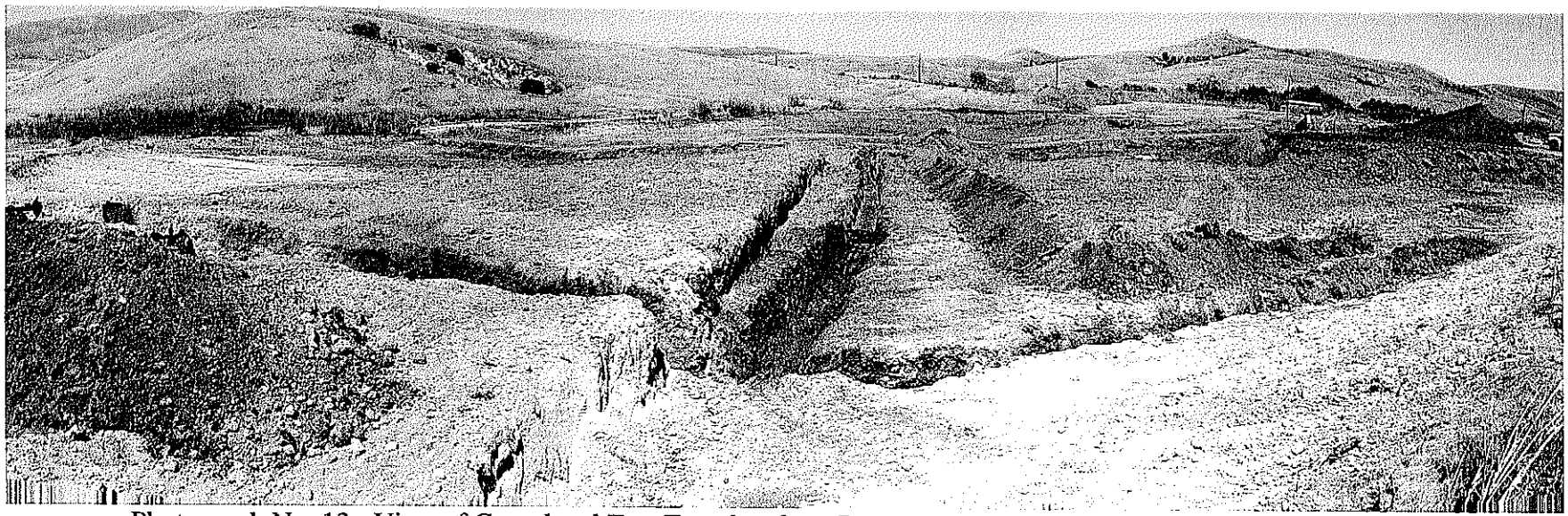
Photograph No. 10: Site 1F Remedial Activities in Progress (July 26, 1999)
PCL # 1



Photograph No. 11: Trenching Prior to Over-Excavation Activities

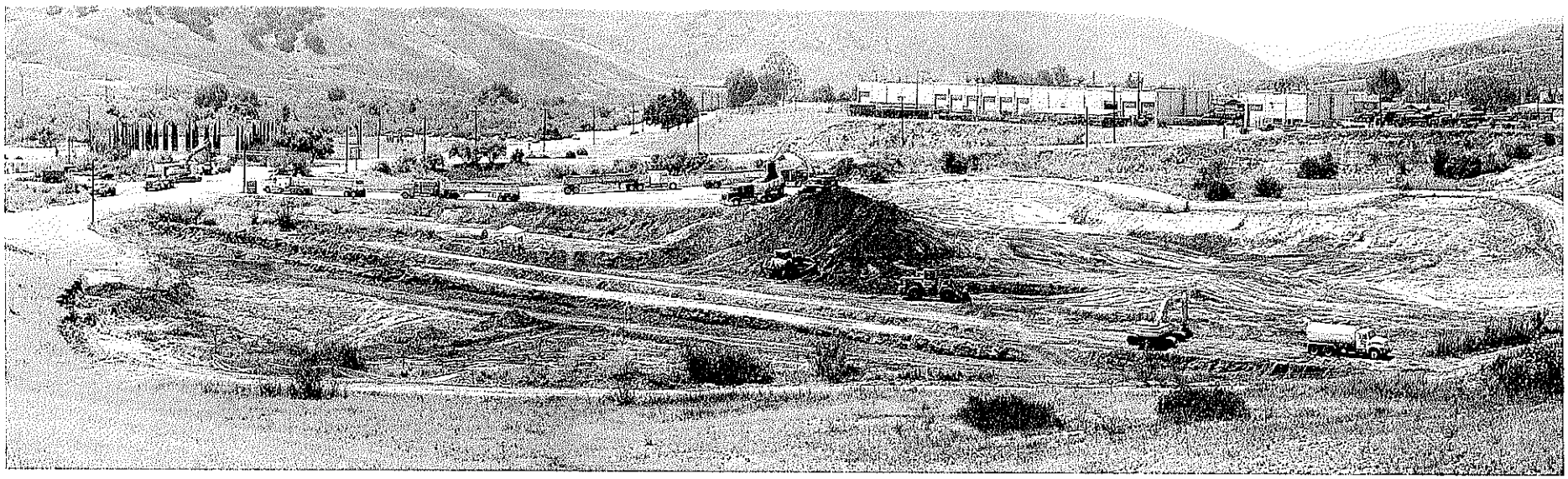


Photograph No. 12: Profile of Debris for Over-Excavation

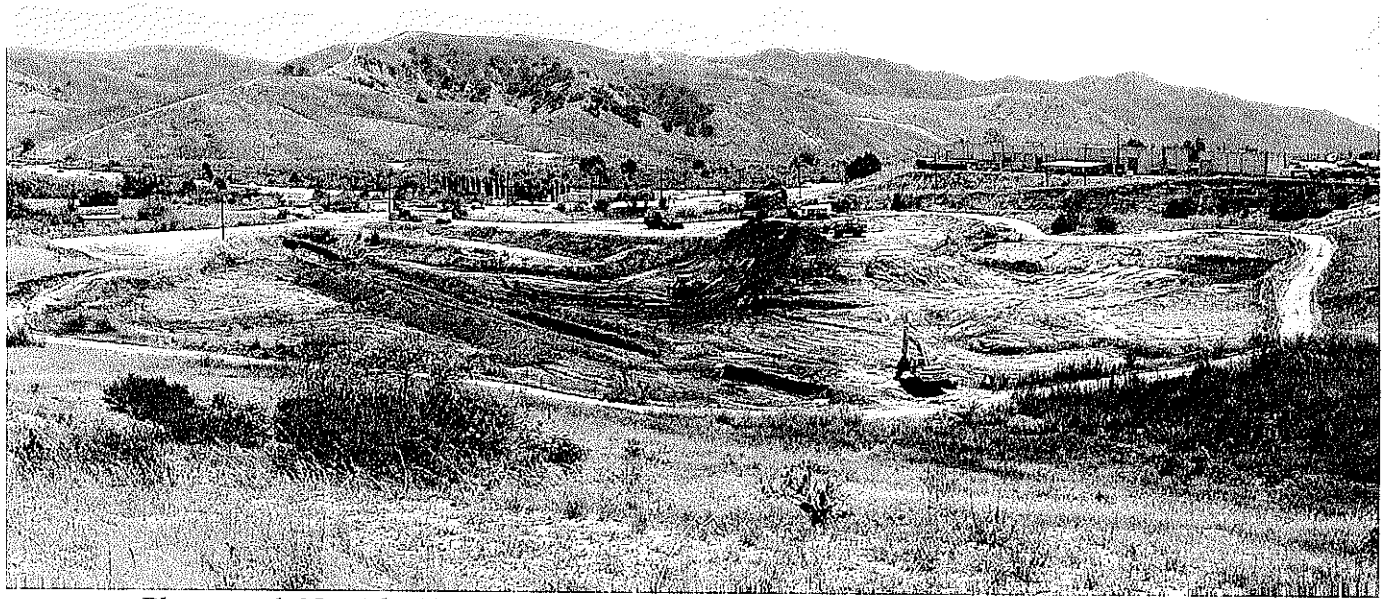


Photograph No. 13: View of Completed Test Trenches from Perimeter Location 1F-1147 (July 21,1999)

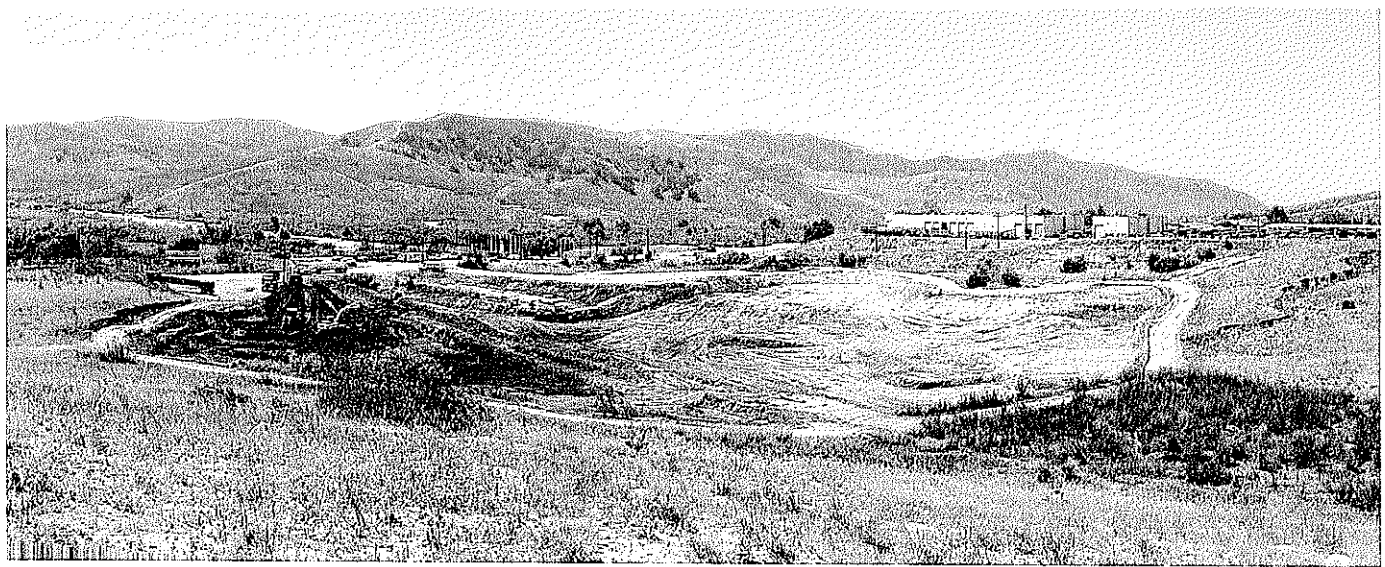
Photograph No. 14: Second Day of Over-Excavation Stage (July 29,1999)
PCL # 1



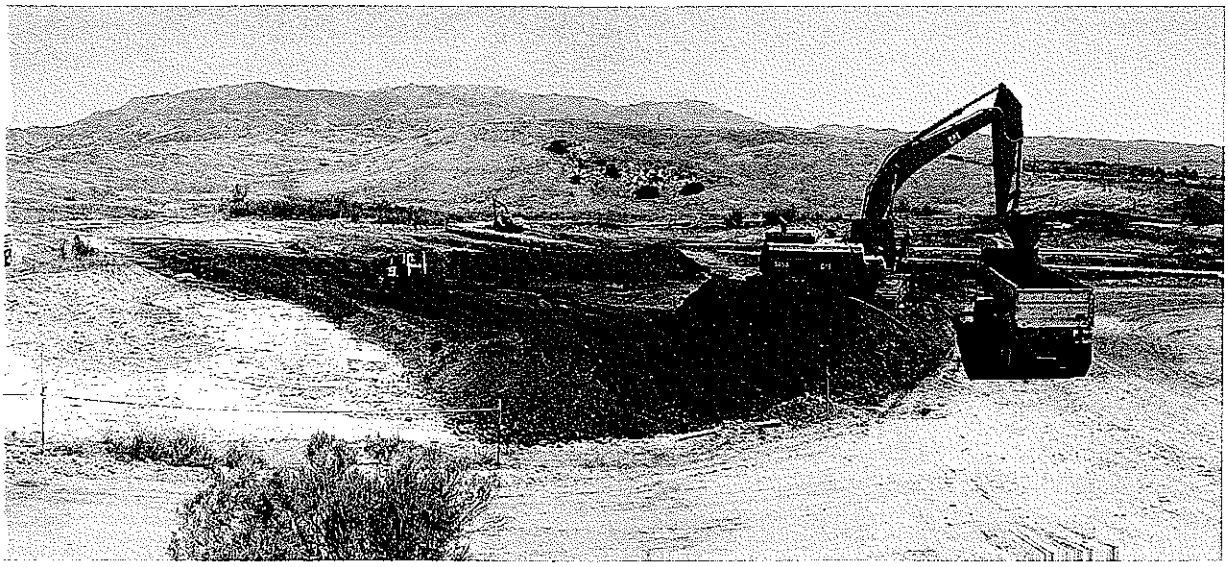
Photograph No. 15: Site 1F Over-Excavation Activities in Progress (August 4,1999)
PCL # 1



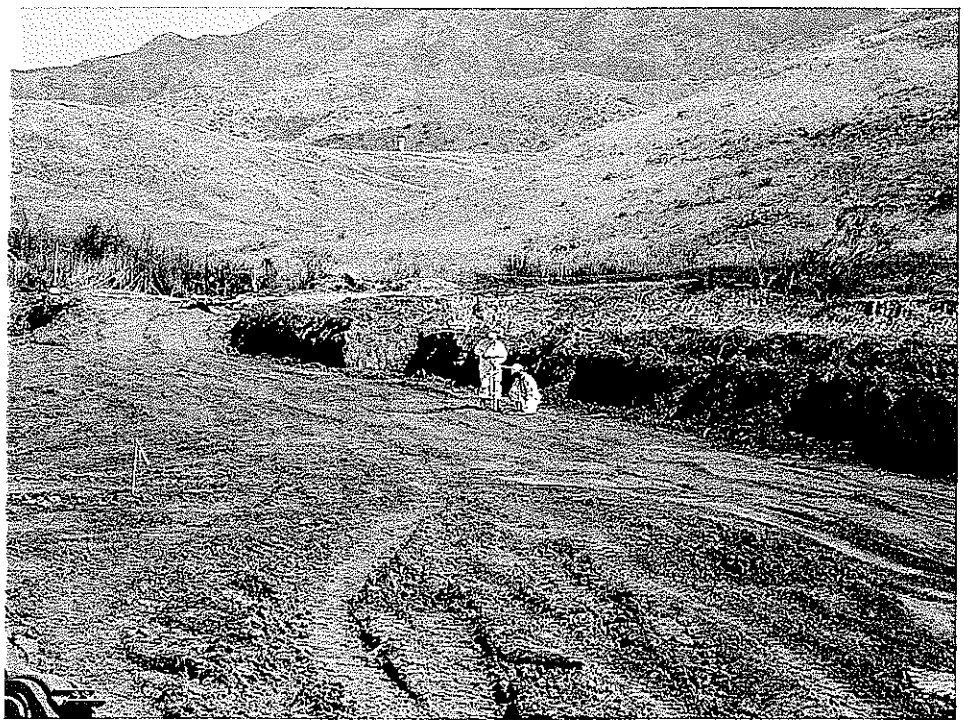
Photograph No. 16: Site 1F Over-Excavation Activities in Progress (August 9,1999)
PCL # 1



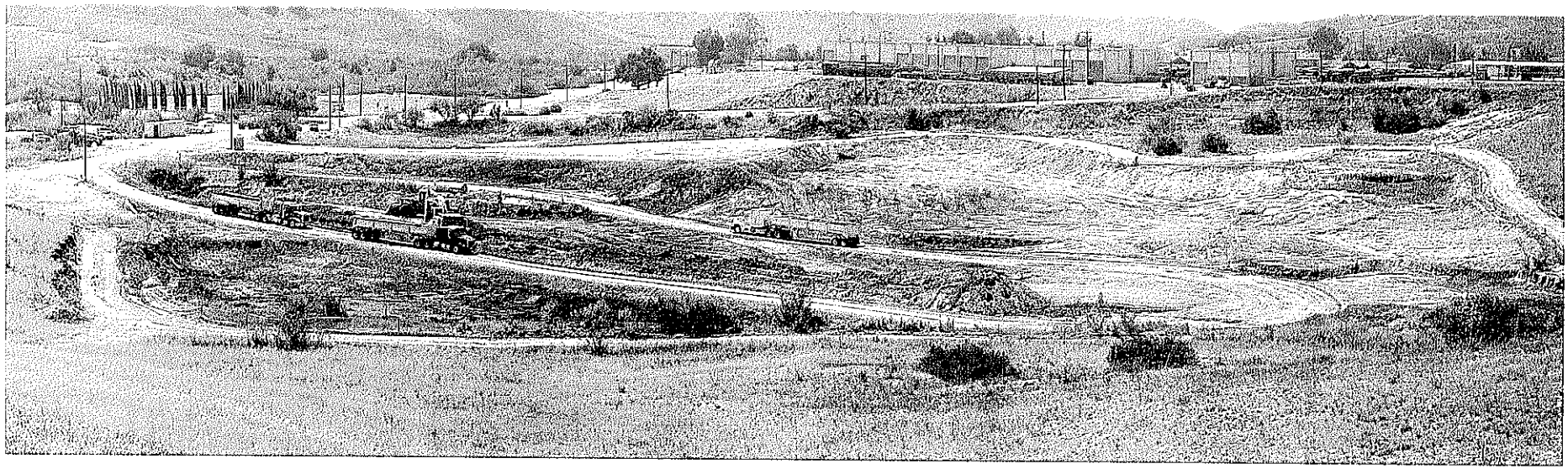
Photograph No. 17: Site 1F Over-Excavation Activities in Progress (August 12,1999)
PCL # 1



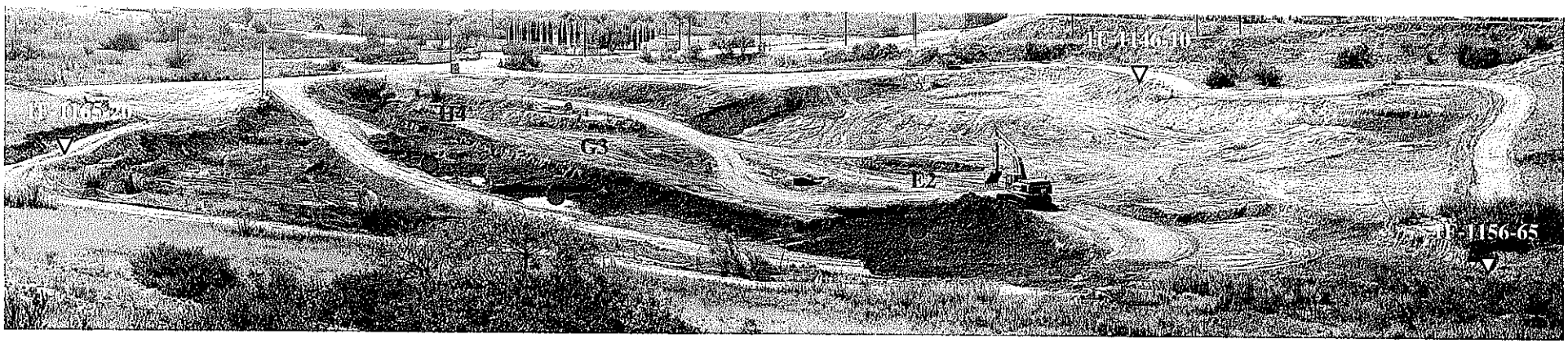
Photograph No. 18: Loading of Over-Excavation Soil from Western Area (July 30,1999)
PCE # 4



Photograph No. 19: Collection of Floor Confirmation Soil Samples From Location F3
(August 23,1999)



Photograph No. 20: Site 1F Streambed Soil Removal and Final Excavation Stage (September 8,1999)
PCL # 1

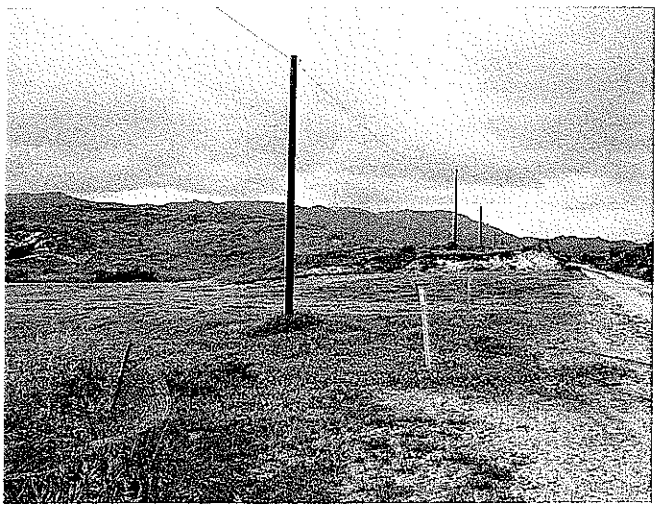


Photograph No. 21: Site 1F Final Excavation Stage Completed (September 20,1999)
PCL # 1

Site Grade Restored and Revegetated
(looking toward west side of site)
April 11, 2001

Center Drainage Swale Restored
(looking toward north side of site)
April 11, 2001

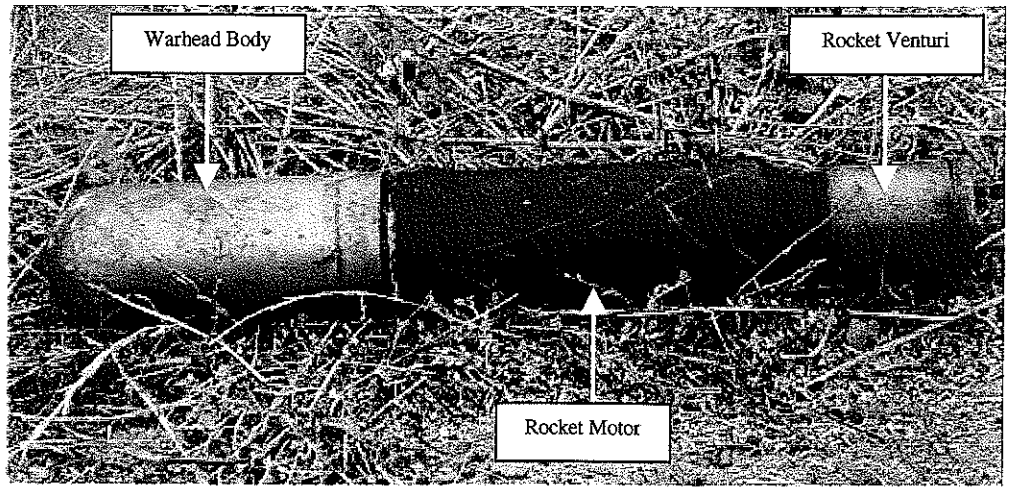
Site Grade Restored and Revegetated
(looking toward northeast side of site)
April 11, 2001

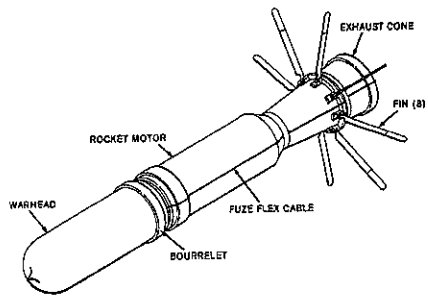


Access Road Restored
(looking toward east side of site)
April 11, 2001

IT Corporation
Unexploded Ordnance Report

U.S. Rocket Assault, 83mm, Dual Mode
SMAW MK 2 Practice





Date:	September 10, 1999
Excavation Number:	1F-06
Location:	Site 1F MCB Camp Pendleton, CA
UXO Identification:	Rocket Assault, 83mm, Dual Mode SMAW MK 2 Practice
Depth Recovered:	Surface
Condition:	Practice Ordnance, Rocket motor has been fired.
Number of Items:	1 ea.

The ordnance item is a practice version of a tube launched unguided dual-purpose rocket. This item is exclusive to the United States Marine Corps. The only ordnance hazards for the practice version are the rocket motor and it's ignition system.

The ordnance item was found on the outskirts of the eastern side of the excavation area. The item was discovered during a walk around conducted by UXO personnel. The rocket was identified and checked to ensure the rocket motor had been fired. The item was deemed safe and was removed from the work area. Area workers were notified as to what was found and advised that additional items may be in the area. The practice ordnance will be kept until the completion of the project for use as a training aid. This item will assist non-UXO personnel in the recognition of UXO.

UXO Supervisor: John Krowitz

APPENDIX C
SITE BACKFILL GEOTECHNICAL CQC REPORT

August 22, 2000
Project No. 103067-16

Mr Max Pan
OHM Remediation/IT Group
1202 Kettner Blvd., Suite 3400
San Diego, California 92101

Subject: Summary of Earthwork Observation and Compaction Testing Services for the Box Canyon Landfill Site 1F Camp Pendleton, California

INTRODUCTION

In accordance with your request, Ninyo and Moore's field representatives have provided geotechnical observations and compaction testing services during the earthwork operations at the Box Canyon Landfill Site 1F. The purpose of our services was to observe and test the placement of backfill material. We performed field and laboratory tests of representative soil samples to evaluate relative compaction of the backfill placed at the site. Our findings and conclusions are presented herein.

EARTHWORK OPERATIONS

Earthwork operations commenced on July 12, 2000, and were generally completed on August 15, 2000. Our field technicians were generally on an on-call basis during the soil fill placement operations. Compaction test results were communicated to the client's representative on a daily basis to determined compliance with project specifications.

During the earthwork operations, the contractor used a combination of earthmoving and compaction equipment to achieve the project specifications. Generally, a CAT 140H motor grader, a CAT 815B sheepsfoot vibratory roller compactor, and a water truck were used to perform the earthwork operations. In preparation for the soil fill placement operation, on-site materials were processed and moisture conditioned using a water truck or water hose. The material was then placed in compacted lifts using a CAT 815B sheepsfoot vibratory roller compactor.

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San Diego • Irvine • Ontario • Los Angeles • Oakland • Las Vegas • Salt Lake City • Phoenix

FIELD AND LABORATORY TESTING

In-place density and moisture content testing was performed by our field representative in accordance with ASTM D2922-91 and D3017-88 (Nuclear Gauge Method). The summary results of field density tests are presented in Table 1. The approximate test locations of compacted fill material are plotted in Figure 1.

Laboratory tests were performed on representative samples of the fill materials to evaluate maximum dry density, optimum moisture content, and gradation. Maximum dry density and optimum moisture content tests were performed in general accordance with ASTM D1557-91. The results of the maximum dry density and optimum moisture content tests are presented in Table 2. Sieve analysis tests were performed in general accordance with ASTM D 422-63, and the results are presented in Table 3.

SUMMARY

Our field technician was generally on-site on an on-call basis during the backfill operations. Compliance of relative compaction and moisture content with the project specifications was determined by the client's representative in the field.

LIMITATIONS

The geotechnical services outlined in this report have been conducted in accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the observations and conclusions expressed in this report. The reported test results represent the relative compaction and moisture content at the locations tested. It is important to note that the precision of field density tests and the maximum dry density tests is not exact and variations should be expected. The reported locations and elevations of the density tests are estimated based on correlations with the site plans. Further accuracy is not implied.

We appreciate this opportunity to be of service. If you should have any questions regarding this report, please contact the undersigned.

Respectfully submitted,
NINYO & MOORE

Luis A. Labrada
Staff Engineer

Mark Cuthbert, P.E
Principal Engineer

LAL/MC/lal

Attachments: Table 1 – Summary of Field Density Tests for Project No. 103067-16
Table 2 – Maximum Density Test Results
Table 3 – Sieve Analysis Test Results

Distribution: (2) Addressee

Explanation of Summary of Field Density Tests

Test No.: 1# Field Density Test by nuclear Method (ASTM D2922-91 and D3017-88)

Test No.: CF Compacted Fill

NOTE: Description of Soil Types are presented in Table 2

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TABLE 1
PAGE 1

SUMMARY OF FIELD DENSITY TESTS FOR PROJECT NO. 103067-16 COMPACTED FILL

Test No.	Date	Test of	Test Location	Approx Elev. (ft)	Moisture Content		Dry Density		Relative Compaction		Soil Type No.	Remarks
					Field (%)	Opt. (%)	Field (pcf)	Max. (pcf)	Tested (%)	Spec. (%)		
1#	07/13/00	CF	SEE FIGURE NO. 1	244.0	8.9	11.2	109.4	123.2	89	80	1	
2#	07/13/00	CF	SEE FIGURE NO. 1	244.0	8.5	11.2	105.3	123.2	85	80	1	
3#	07/13/00	CF	SEE FIGURE NO. 1	245.0	10.9	11.2	107.3	123.2	87	80	1	
4#	07/13/00	CF	SEE FIGURE NO. 1	245.0	11.7	11.2	109.9	123.2	89	80	1	
5#	07/13/00	CF	SEE FIGURE NO. 1	246.0	8.4	11.2	105.4	123.2	86	80	1	
6#	07/13/00	CF	SEE FIGURE NO. 1	246.0	9.0	11.2	109.2	123.2	89	80	1	
7#	07/13/00	CF	SEE FIGURE NO. 1	247.0	10.0	11.2	107.3	123.2	87	80	1	
8#	07/13/00	CF	SEE FIGURE NO. 1	247.0	11.8	11.2	109.9	123.2	89	80	1	
9#	07/14/00	CF	SEE FIGURE NO. 1	246.0	11.4	11.2	104.2	123.2	85	80	1	
10#	07/14/00	CF	SEE FIGURE NO. 1	246.0	12.4	11.2	101.8	123.2	83	80	1	
11#	07/14/00	CF	SEE FIGURE NO. 1	247.0	11.8	11.2	105.7	123.2	86	80	1	
12#	07/14/00	CF	SEE FIGURE NO. 1	246.0	11.3	11.2	105.4	123.2	86	80	1	
13#	07/14/00	CF	SEE FIGURE NO. 1	247.0	11.4	11.2	104.2	123.2	85	80	1	
14#	07/14/00	CF	SEE FIGURE NO. 1	248.0	10.8	11.2	109.5	123.2	89	80	1	
15#	07/14/00	CF	SEE FIGURE NO. 1	247.0	9.0	11.2	113.2	123.2	92	80	1	
16#	07/14/00	CF	SEE FIGURE NO. 1	247.0	10.0	11.2	108.4	123.2	88	80	1	
17#	07/14/00	CF	SEE FIGURE NO. 1	248.5	10.4	11.2	116.6	123.2	95	80	1	
18#	07/14/00	CF	SEE FIGURE NO. 1	248.5	11.1	11.2	109.7	123.2	89	80	1	
19#	07/17/00	CF	SEE FIGURE NO. 1	267.5	10.2	11.2	113.1	123.2	92	80	1	
20#	07/17/00	CF	SEE FIGURE NO. 1	259.0	10.2	11.2	109.9	123.2	89	80	1	
21#	07/17/00	CF	SEE FIGURE NO. 1	268.0	10.5	11.2	110.6	123.2	90	80	1	
22#	07/17/00	CF	SEE FIGURE NO. 1	264.0	9.6	11.2	116.1	123.2	94	80	1	
23#	07/17/00	CF	SEE FIGURE NO. 1	256.0	7.8	11.2	110.6	123.2	90	80	1	
24#	07/17/00	CF	SEE FIGURE NO. 1	269.5	10.4	11.2	113.6	123.2	92	80	1	
25#	07/18/00	CF	SEE FIGURE NO. 1	269.5	10.6	11.2	108.4	123.2	88	80	1	
26#	07/18/00	CF	SEE FIGURE NO. 1	261.0	10.0	11.2	107.1	123.2	87	80	1	
27#	07/18/00	CF	SEE FIGURE NO. 1	254.5	10.4	11.2	108.7	123.2	88	80	1	
28#	07/18/00	CF	SEE FIGURE NO. 1	265.0	11.3	11.2	114.1	123.2	93	80	1	
29#	07/18/00	CF	SEE FIGURE NO. 1	254.0	10.8	11.2	104.6	123.2	85	80	1	
30#	07/18/00	CF	SEE FIGURE NO. 1	252.0	10.4	11.2	113.5	123.2	92	80	1	
31#	07/19/00	CF	SEE FIGURE NO. 1	253.0	9.2	11.2	113.9	123.2	92	80	1	
32#	07/19/00	CF	SEE FIGURE NO. 1	260.0	10.4	11.2	114.5	123.2	93	80	1	
33#	07/19/00	CF	SEE FIGURE NO. 1	265.0	11.9	11.2	105.2	123.2	85	80	1	
34#	07/19/00	CF	SEE FIGURE NO. 1	257.0	9.2	11.2	115.2	123.2	94	80	1	
35#	07/19/00	CF	SEE FIGURE NO. 1	266.0	11.1	11.2	111.2	123.2	90	80	1	
36#	07/19/00	CF	SEE FIGURE NO. 1	274.0	10.6	11.2	112.7	123.2	91	80	1	
37#	07/20/00	CF	SEE FIGURE NO. 1	249.0	9.8	11.2	113.0	123.2	92	80	1	
38#	07/20/00	CF	SEE FIGURE NO. 1	249.5	9.4	11.2	113.3	123.2	92	80	1	
39#	07/20/00	CF	SEE FIGURE NO. 1	250.0	11.4	11.2	107.8	123.2	88	80	1	
40#	07/20/00	CF	SEE FIGURE NO. 1	250.5	10.8	11.2	112.0	123.2	91	80	1	

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TABLE 1
PAGE 2

SUMMARY OF FIELD DENSITY TESTS FOR PROJECT NO. 103067-16 COMPACTED FILL

Test No.	Date	Test of	Test Location	Approx Elev. (ft)	Moisture Content		Dry Density		Relative Compaction		Soil Type No.	Remarks
					Field (%)	Opt. (%)	Field (pcf)	Max. (pcf)	Tested (%)	Spec. (%)		
41#	07/20/00	CF	SEE FIGURE NO. 1	254.5	10.3	11.2	113.8	123.2	92	80	1	
42#	07/20/00	CF	SEE FIGURE NO. 1	255.0	10.2	11.2	113.4	123.2	92	80	1	
43#	07/20/00	CF	SEE FIGURE NO. 1	255.5	9.0	11.2	116.0	123.2	94	80	1	
44#	07/20/00	CF	SEE FIGURE NO. 1	260.5	8.8	11.2	109.9	123.2	89	80	1	
45#	07/20/00	CF	SEE FIGURE NO. 1	257.0	12.5	11.2	109.8	123.2	89	80	1	
46#	07/20/00	CF	SEE FIGURE NO. 1	252.5	12.1	11.2	110.6	123.2	90	80	1	
47#	07/24/00	CF	SEE FIGURE NO. 1	249.5	7.1	11.2	116.1	123.2	94	80	1	
48#	07/24/00	CF	SEE FIGURE NO. 1	248.0	11.8	11.2	114.0	123.2	93	80	1	
49#	07/24/00	CF	SEE FIGURE NO. 1	248.0	10.1	11.2	113.8	123.2	92	80	1	
50#	07/24/00	CF	SEE FIGURE NO. 1	248.0	10.0	11.2	115.5	123.2	94	80	1	
51#	07/24/00	CF	SEE FIGURE NO. 1	249.0	8.0	11.2	117.9	123.2	96	80	1	
52#	07/24/00	CF	SEE FIGURE NO. 1	249.5	10.5	11.2	107.4	123.2	87	80	1	
53#	07/26/00	CF	SEE FIGURE NO. 1	249.0	8.5	11.2	116.7	123.2	95	80	1	
54#	07/26/00	CF	SEE FIGURE NO. 1	249.0	10.3	11.2	117.5	123.2	95	80	1	
55#	07/26/00	CF	SEE FIGURE NO. 1	250.5	11.1	11.2	111.8	123.2	91	80	1	
56#	07/26/00	CF	SEE FIGURE NO. 1	258.0	8.5	11.2	112.0	123.2	91	80	1	
57#	07/26/00	CF	SEE FIGURE NO. 1	271.0	8.0	11.2	116.7	123.2	95	80	1	
58#	07/26/00	CF	SEE FIGURE NO. 1	262.0	9.2	11.2	107.1	123.2	87	80	1	
59#	07/26/00	CF	SEE FIGURE NO. 1	250.0	9.9	11.2	111.8	123.2	91	80	1	
60#	07/26/00	CF	SEE FIGURE NO. 1	250.0	12.1	11.2	109.0	123.2	88	80	1	
61#	07/26/00	CF	SEE FIGURE NO. 1	251.0	8.4	11.2	119.4	123.2	97	80	1	
62#	07/26/00	CF	SEE FIGURE NO. 1	249.0	9.3	11.2	112.9	123.2	92	80	1	
63#	07/26/00	CF	SEE FIGURE NO. 1	249.0	10.5	11.2	114.0	123.2	93	80	1	
64#	07/28/00	CF	SEE FIGURE NO. 1	250.5	9.4	11.2	113.6	123.2	92	80	1	
65#	07/28/00	CF	SEE FIGURE NO. 1	250.5	10.2	11.2	104.2	123.2	85	80	1	
66#	07/28/00	CF	SEE FIGURE NO. 1	251.0	11.5	11.2	108.2	123.2	88	80	1	
67#	07/28/00	CF	SEE FIGURE NO. 1	251.0	9.0	11.2	110.9	123.2	90	80	1	
68#	07/28/00	CF	SEE FIGURE NO. 1	251.0	11.8	11.2	113.4	123.2	92	80	1	
69#	07/28/00	CF	SEE FIGURE NO. 1	250.0	8.7	11.2	111.6	123.2	91	80	1	
70#	07/28/00	CF	SEE FIGURE NO. 1	249.5	9.1	11.2	108.6	123.2	88	80	1	
71#	07/28/00	CF	SEE FIGURE NO. 1	251.0	11.9	11.2	108.8	123.2	88	80	1	
72#	07/28/00	CF	SEE FIGURE NO. 1	254.0	11.5	11.2	106.0	123.2	86	80	1	
73#	07/28/00	CF	SEE FIGURE NO. 1	256.0	9.0	11.2	106.7	123.2	87	80	1	
74#	07/28/00	CF	SEE FIGURE NO. 1	264.0	9.2	11.2	107.1	123.2	87	80	1	
75#	07/28/00	CF	SEE FIGURE NO. 1	253.0	10.3	11.2	111.3	123.2	90	80	1	
76#	07/31/00	CF	SEE FIGURE NO. 1	255.0	10.1	11.2	105.1	123.2	85	80	1	
77#	07/31/00	CF	SEE FIGURE NO. 1	254.0	10.7	11.2	108.3	123.2	88	80	1	
78#	07/31/00	CF	SEE FIGURE NO. 1	253.0	10.5	11.2	110.8	123.2	90	80	1	
79#	07/31/00	CF	SEE FIGURE NO. 1	253.0	9.4	11.2	112.1	123.2	91	80	1	
80#	07/31/00	CF	SEE FIGURE NO. 1	252.5	9.5	11.2	108.9	123.2	88	80	1	

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TABLE 1
PAGE 3

SUMMARY OF FIELD DENSITY TESTS FOR PROJECT NO. 103067-16 COMPACTED FILL

Test No.	Date	Test of	Test Location	Approx Elev. (ft)	Moisture Content		Dry Density		Relative Compaction		Soil Type No.	Remarks
					Field (%)	Opt. (%)	Field (pcf)	Max. (pcf)	Tested (%)	Spec. (%)		
81#	07/31/00	CF	SEE FIGURE NO. 1	251.5	9.9	11.2	113.4	123.2	92	80	1	
82#	07/31/00	CF	SEE FIGURE NO. 1	252.5	10.6	11.2	108.9	123.2	88	80	1	
83#	07/31/00	CF	SEE FIGURE NO. 1	205.5	10.3	11.2	112.1	123.2	91	80	1	
84#	08/01/00	CF	SEE FIGURE NO. 1	266.0	11.3	11.2	108.8	123.2	88	80	1	
85#	08/01/00	CF	SEE FIGURE NO. 1	270.0	11.4	11.2	107.7	123.2	87	80	1	
86#	08/01/00	CF	SEE FIGURE NO. 1	259.0	9.4	11.2	113.6	123.2	92	80	1	
87#	08/01/00	CF	SEE FIGURE NO. 1	250.0	9.0	11.2	103.9	123.2	84	80	1	
88#	08/01/00	CF	SEE FIGURE NO. 1	251.0	10.0	11.2	109.1	123.2	89	80	1	
89#	08/01/00	CF	SEE FIGURE NO. 1	251.0	8.9	11.2	111.5	123.2	91	80	1	
90#	08/01/00	CF	SEE FIGURE NO. 1	255.5	9.7	11.2	111.0	123.2	90	80	1	
91#	08/01/00	CF	SEE FIGURE NO. 1	253.5	10.2	11.2	107.9	123.2	88	80	1	
92#	08/01/00	CF	SEE FIGURE NO. 1	256.0	9.6	11.2	112.8	123.2	92	80	1	
93#	08/01/00	CF	SEE FIGURE NO. 1	254.0	12.5	11.2	107.6	123.2	87	80	1	
94#	08/03/00	CF	SEE FIGURE NO. 1	272.0	8.9	11.2	113.1	123.2	92	80	1	
95#	08/03/00	CF	SEE FIGURE NO. 1	269.0	9.8	11.2	112.7	123.2	91	80	1	
96#	08/03/00	CF	SEE FIGURE NO. 1	268.5	8.7	11.2	113.8	123.2	92	80	1	
97#	08/03/00	CF	SEE FIGURE NO. 1	261.5	8.8	11.2	112.2	123.2	91	80	1	
98#	08/03/00	CF	SEE FIGURE NO. 1	268.0	10.3	11.2	110.2	123.2	89	80	1	
99#	08/03/00	CF	SEE FIGURE NO. 1	262.0	9.7	11.2	108.9	123.2	88	80	1	
100#	08/03/00	CF	SEE FIGURE NO. 1	356.5	8.7	11.2	110.2	123.2	89	80	1	
101#	08/03/00	CF	SEE FIGURE NO. 1	252.5	9.8	11.2	109.6	123.2	89	80	1	
102#	08/03/00	CF	SEE FIGURE NO. 1	251.5	9.9	11.2	111.3	123.2	90	80	1	
103#	08/03/00	CF	SEE FIGURE NO. 1	252.0	9.2	11.2	109.9	123.2	89	80	1	
104#	08/03/00	CF	SEE FIGURE NO. 1	255.0	9.6	11.2	108.0	123.2	88	80	1	
105#	08/03/00	CF	SEE FIGURE NO. 1	260.5	10.5	11.2	109.8	123.2	89	80	1	
106#	08/03/00	CF	SEE FIGURE NO. 1	255.0	8.6	11.2	105.1	123.2	85	80	1	
107#	08/03/00	CF	SEE FIGURE NO. 1	255.5	10.6	11.2	113.6	123.2	92	80	1	
108#	08/03/00	CF	SEE FIGURE NO. 1	257.5	9.4	11.2	107.0	123.2	87	80	1	
109#	08/03/00	CF	SEE FIGURE NO. 1	254.0	9.3	11.2	108.9	123.2	88	80	1	
110#	08/07/00	CF	SEE FIGURE NO. 1	266.0	8.8	11.2	111.7	123.2	91	80	1	
111#	08/07/00	CF	SEE FIGURE NO. 1	257.5	8.8	11.2	111.7	123.2	91	80	1	
112#	08/07/00	CF	SEE FIGURE NO. 1	253.0	8.8	11.2	113.4	123.2	92	80	1	
113#	08/07/00	CF	SEE FIGURE NO. 1	259.0	9.9	11.2	110.0	123.2	89	80	1	
114#	08/07/00	CF	SEE FIGURE NO. 1	250.5	9.1	11.2	112.9	123.2	92	80	1	
115#	08/07/00	CF	SEE FIGURE NO. 1	253.0	9.6	11.2	114.1	123.2	93	80	1	
116#	08/07/00	CF	SEE FIGURE NO. 1	261.0	8.7	11.2	110.1	123.2	89	80	1	
117#	08/07/00	CF	SEE FIGURE NO. 1	254.5	8.4	11.2	117.2	123.2	95	80	1	
118#	08/07/00	CF	SEE FIGURE NO. 1	251.0	11.0	11.2	110.8	123.2	90	80	1	
119#	08/07/00	CF	SEE FIGURE NO. 1	255.0	9.7	11.2	111.0	123.2	90	80	1	
120#	08/07/00	CF	SEE FIGURE NO. 1	256.0	10.9	11.2	110.1	123.2	89	80	1	

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TABLE 1
PAGE 4

SUMMARY OF FIELD DENSITY TESTS FOR PROJECT NO. 103067-16 COMPACTED FILL

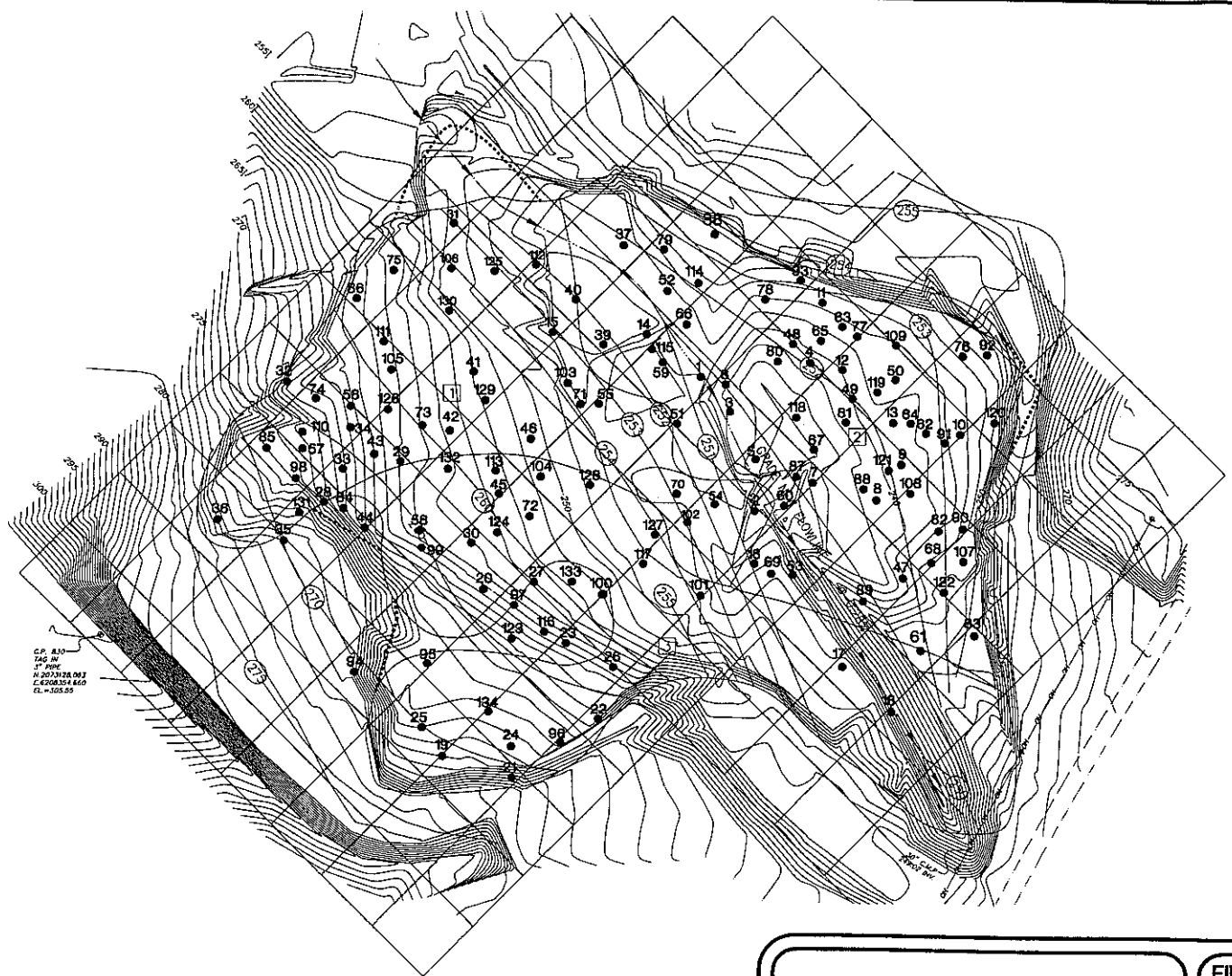
Test No.	Date	Test of	Test Location	Approx Elev. (ft)	Moisture Content		Dry Density		Relative Compaction		Soil Type No.	Remarks
					Field (%)	Opt. (%)	Field (pcf)	Max. (pcf)	Tested (%)	Spec. (%)		
121#	08/07/00	CF	SEE FIGURE NO. 1	253.0	10.4	11.2	105.2	123.2	85	80	1	
122#	08/07/00	CF	SEE FIGURE NO. 1	254.0	11.0	11.2	108.8	123.2	88	80	1	
123#	08/08/00	CF	SEE FIGURE NO. 1	262.0	10.8	11.2	111.5	123.2	91	80	1	
124#	08/08/00	CF	SEE FIGURE NO. 1	258.0	8.5	11.2	112.0	123.2	91	80	1	
125#	08/08/00	CF	SEE FIGURE NO. 1	254.5	8.5	11.2	108.9	123.2	88	80	1	
126#	08/08/00	CF	SEE FIGURE NO. 1	264.0	9.1	11.2	110.5	123.2	90	80	1	
127#	08/11/00	CF	SEE FIGURE NO. 1	254.0	9.9	11.2	114.0	123.2	92	80	1	
128#	08/11/00	CF	SEE FIGURE NO. 1	255.0	7.3	11.2	117.8	123.2	96	80	1	
129#	08/11/00	CF	SEE FIGURE NO. 1	259.0	9.0	11.2	114.0	123.2	93	80	1	
130#	08/11/00	CF	SEE FIGURE NO. 1	264.0	11.3	11.2	110.8	123.2	90	80	1	
131#	08/11/00	CF	SEE FIGURE NO. 1	270.0	9.8	11.2	115.6	123.2	94	80	1	
132#	08/11/00	CF	SEE FIGURE NO. 1	263.5	9.2	11.2	116.2	123.2	95	80	1	
133#	08/11/00	CF	SEE FIGURE NO. 1	262.0	10.2	11.2	108.7	123.2	88	80	1	
134#	08/11/00	CF	SEE FIGURE NO. 1	267.0	10.0	11.2	110.4	123.2	90	80	1	

Table 2 – Maximum Density Test Results

Soil Type No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
1	Brown Clayey SAND with Gravel	123.2	11.2

Table 3 – Sieve Analysis Test Results

Sieve Size	Percent Passing
	Soil Type No. 5
1"	
3/4"	
1/2"	
3/8"	100
#4	100
#8	98
#16	93
#30	75
#50	50
#100	32
#200	21



LEGEND

● 124 Approximate location of compaction fill density test

NOTE: PLAN PREPARED DURING ON-SITE RECONNAISSANCE AND SHOULD NOT BE CONSIDERED A RECORD OF SURVEY. ALL DIMENSIONS ARE APPROXIMATE.

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FIELD DENSITY TEST LOCATION MAP

BOX CANYON LAND FILL SITE 1F
OCEANSIDE, CLIFORNIA

PROJECT NO.	DATE	FIGURE
103067-16	8/00	1

G:\103067\DPD print:80

APPENDIX D
SITE REVEGETATION SEED MIX

Hydroseeding Specifications

Hydroseeding shall be used to establish ground cover and introduce an upland native seed mix to each site. Application of hydroseed shall begin no less than 30 days following the placement of soil amendments where required, unless otherwise directed by IT. The hydroseed mixture shall consist of the three parts described below:

- Upland native seed mix at a rate of 55 pounds per acre. The seed mix shall consist of the following:

Botanical Name	Common Name	Pounds/Acre	Purity/Germination
Artemisia californica	California Sage Brush	4	50/15
Encelia californica	Bush Sunflower	3	60/40
Eschschlozia californica	California Poppy	2	75/98
Lotus scoparius	Deerweed	8	60/90
Eriogonum fasciculatum	California Buckwheat	8	65/10
Lasthenia glabrata	Goldfields	2	85/90
Lupinus succulentus	Arroyo Lupine	4	85/90
Eriophyllum confertiflorum	Golden Yarrow	3	60/30
Salvia apiana	White Sage	4	50/70
Sisyrinchium bellum	Blue-Eyed Grass	1	75/95
Diplacus longiflor-us	Monkey Flower	2	55/2
Salvia mellifera	Black Sage	4	50/70
Nassella pulchra	Purple Needlegrass	2	70/60
Bromus arizonicus	Cucamonga Brome	5	95/80
Melica california	California Melic	3	90/60
	Total Pounds Per Acre	**55**	

- Fiber mulch at a rate of 2,000 pounds per acre.
- Organic soil stabilant (tackifier) at a rate of 140 pounds per acres.

The fiber mulch shall be a specifically prepared virgin wood cellulose fiber, which has been thermomechanically processed for specific use as hydromulch. The fiber mulch shall also contain non-toxic green dye to provide a gage for metering of material over ground surfaces. The tackifier shall be a non-toxic commercial product typically used for binding soil and mulch in erosion control seeding operations. The hydroseeding shall be performed from late October to late November before the start of the winter rainy season

Field Quality Control

The following activities will be performed by IT during the site restoration process:

- Visual inspections will be performed to verify that proper amount of compost (based on number of truck loads and surface area), gypsum, and fertilizer are applied and that they are thoroughly mixed with the upper six inch of backfill soil.

- Visual inspection of the hydroseeding process to verify that the proper amount of each of the components is applied

- Document the visual inspection and all field activities in details. Take photographs as required to show the field conditions before, during, and after the revegetation effort.

Compile field documentation into the final site closure as-built report as required

APPENDIX E
ANALYTICAL DATA SUMMARY AND EVALUATION

Data Summary and Evaluation – IR Site 1F Remedial Action Confirmation Sampling Results

E.1 Introduction

This report addresses the validity and quality of the data collected for soil excavation activity at Operable Unit (OU) 3, Site 1F located at Marine Corps Base (MCB) Camp Pendleton, San Diego County, California. Analytical data were reviewed and validated in accordance with a modified outline of the United States Environmental Protection Agency (US EPA) National Functional Guidelines for Inorganic Data Review, December, 1994 The National Functional Guidelines, which are an outcome of the CERCLA and the CLP, were used as a framework for the validation of data generated using SW846 methodology

Laboratory data were subjected to a four-stage process of evaluation that included completeness checks, verification of hard copy and electronic results, third-party validation of the data, and final evaluation based on the best judgment of the project chemist.

The data from all final perimeter (wall) samples collected in December 1998 and from all final floor confirmation samples collected throughout 1999 were validated based on Level C or Level D (NFESC, 1996) guidelines, which included the following criteria:

- holding times
- initial and continuing calibrations
- method, initial and continuing blanks
- interference check standards A and B
- matrix spike/matrix spike duplicate (MS/MSD) recoveries and relative percent difference (RPD)
- laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries and RPD
- serial dilution spike recoveries
- duplicate field sample RPD
- result forms and laboratory logs
- field and quality control sample raw data (Level D only)

The laboratory was instructed to prepare data packages such that 90% met Level C requirements and 10% met Level D requirements.

Data qualification was based on the field and analytical protocols detailed in the *Draft Final Remedial Design and Remedial Action Work Plan, Marine Corps Base Camp Pendleton, California (OHM, May 1999)*. Pertinent data qualifiers are defined as follows:

U: Element was analyzed for but not detected at or above the listed limit of detection
J: Element detected with uncertainty in the reported concentration
UJ: Element was not detected with uncertainty in the reported detection limit
R: Data are unusable (i e., rejected)

Pertinent sample results and their associated data qualifiers are presented in Table E-1 and Table E-2 of this report. Analytical services were provided by Applied Physics and Chemistry Laboratory in Chino, California Data validation was performed by Laboratory Data Consultants, Inc., in Carlsbad, California

Although the QAPP lists EPA 7060A as the method for analyzing arsenic, the laboratory used Method 6010A, which is a procedurally and technically satisfactory method. Furthermore, the level of detection was not compromised by using Method 6010A.

The antimony results for 19739-666 and 19739-667 were reported as none-detected with reporting limits of 22 mg/kg and 26 mg/kg, respectively. The reporting limits were elevated due to sample matrix interference that required dilutions.

E.2 Analytical Quality Control Program

This section provides a description of the field and laboratory quality control (QC) sample results which were used to evaluate precision, accuracy, representativeness, completeness, and comparability (PARCC).

Precision

Precision was evaluated based on results from QC samples collected in the field and on results from QC samples generated in the laboratory. Analytical precision is assessed by calculating the RPDs of the LCS/LCSD and the MS/MSD. Total precision, which is a measure of variability as a function of field and analytical procedures, is assessed by calculating the RPD of the field duplicate samples. The RPD for MS/MSD or duplicate samples is not calculable when one or both results were not detected.

The precision results for all samples were within the required QC limits.

Accuracy

Accuracy was evaluated based on the percent recovery of spiked analytes at known concentrations in MS/MSDs and LCS/LCSDs. In addition, evaluation of the initial and continuing calibration results provided information on analytical accuracy.

Accuracy for all samples were within the required QC limits with the following exceptions:

- Percent recoveries of arsenic in the MS/MSD linked with the laboratory batch including sample 1F-D6-02 were outside the QC acceptance limits. However, the percent recoveries of arsenic in the associated LCS/LCSD were within the QC acceptance limits indicating acceptable batch accuracy and therefore the affected result was not qualified
- Percent recovery of zinc in the MSD linked with the laboratory batch including sample 1F-F1-01 was outside the QC acceptance limits. However, the percent recovery of zinc in the associated LCSD was within the QC acceptance limits indicating acceptable batch accuracy and therefore the affected result was not qualified
- Percent recoveries of zinc in the MS/MSD linked with the laboratory batch including samples 1F-G2-02 and 1F-H2-01 were outside the QC acceptance limits. However, the percent recoveries of zinc in the associated LCS/LCSD were within QC acceptance limits indicating acceptable batch accuracy and therefore the affected results were not qualified
- Percent recoveries of copper and zinc in the MS/MSD linked with the laboratory batch including samples 1F-B4-01, 1F-A4-01, 1F-D1-02, 1F-C1-01 and 1F-C6-02 were outside the QC acceptance limits. However, the percent recoveries of copper and zinc in the associated LCS/LCSD were within QC acceptance limits indicating acceptable batch accuracy and therefore the affected results were not qualified.
- Percent recoveries of lead in the MS/MSD linked with the laboratory batch including sample 1F-1165-20' were outside the QC acceptance limits. However, the percent recoveries of lead in the associated LCS/LCSD were within QC acceptance limits indicating acceptable batch accuracy and therefore the affected result was not qualified.

Representativeness

Representativeness is a qualitative parameter which is described by the degree of accuracy and precision of the sample data and their reflection on the environment from where the samples were collected, conditions present during sample collection, or the attributes of a sample population.

The data presented in Table E-1 and Table E-2 of this report were found to be representative.

Completeness

Completeness is determined by calculating the number of valid measurements (or results) for each matrix and analyte combination. (A valid result is one that has not been "R" qualified.) The formula for completeness is the number of valid measurements divided by the total number of measurements multiplied by 100. A particular set of data are considered complete if, at a minimum, 90% of soil samples or 95% of aqueous samples meet the completeness criterion.

The data presented in Table E-1 and Table E-2 of this report were found to be complete

Comparability

To ensure comparability, the Work Plan detailed specific procedures for both field and laboratory activities. Furthermore, the Work Plan required the laboratory to reference US EPA analytical methods, and all soil samples were reported on a dry weight basis

No significant deviations from standard analytical protocols were reported by the laboratory

E.3 Summary

The data associated with the excavation activities at Site 1F at MCB Camp Pendleton described in this report are usable and acceptable as qualified. Overall precision and accuracy objective were met The analytical results with their associated qualifiers are summarized in Table E-1 and Table E-2.

Table E-1
Summary of Final Perimeter (Wall) Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-076	19739-078	19739-081	19739-086	19739-088	19739-090	19739-092
Location Code		1F-1133	1F-1131	1F-1167	1F-1163	1F-1161	1F-1159	1F-1155
Date Sampled		12/09/98	12/09/98	12/09/98	12/09/98	12/09/98	12/10/98	12/10/98
Depth (feet below ground surface)		3.0	2.0	2.0	2.0	2.0	2.0	3.0
	Unit							
EPA 6010								
Antimony	mg/kg	0.42 U	0.43 U	0.45 U	0.42 U	0.43 U	0.42 U	0.43 U
Arsenic	mg/kg	3.8	4.5	7.3	5.4	1.2 U	1.3	3.2
Copper	mg/kg	25.2	30.3	32.7	25.5	56.8	3.3 U	8.2
Iron	mg/kg	20600	22600	24400	19800	13200	11600	14000
Lead	mg/kg	9.8	3.4	3.6	2.8	3.8	6.3	4.9
Zinc	mg/kg	70.1	33.3	38.2	32.1	41.7	42.9	21.8

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-1
Summary of Final Perimeter (Wall) Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-093	19739-094 (Dup)	19739-095	19739-096	19739-098	19739-099	19739-102
Location Code		1F-1157	1F-1157	1F-1153	1F-1151	1F-1149	1F-1148	1F-1144
Date Sampled		12/10/98	12/10/98	12/10/98	12/10/98	12/10/98	12/10/98	12/10/98
Depth (feet below ground surface)		3.0	3.0	3.0	3.0	3.0	3.0	3.0
EPA 6010	Unit							
Antimony	mg/kg	0.44 U	0.44 U	0.42 U	0.48 U	0.43 U	0.45 J	0.45 U
Arsenic	mg/kg	18.4	4.6	2.7	0.38 J	1.0 J	3.0	1.4
Copper	mg/kg	30.2	24.2	4.0 U	2.9 U	3.8 U	5.6 U	7.7
Iron	mg/kg	22100	18400	8670	4360	6430	10900	12800
Lead	mg/kg	7.9	8.5	3.3	2.3	3.7	4.6	3.4
Zinc	mg/kg	42.1	43.5	16.6	13.5	16.4	14.9	26.4

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-1
Summary of Final Perimeter (Wall) Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-104	19739-108	19739-110	19739-111	19739-114	19739-297	19739-563
Location Code		1F-1142	1F-1140	1F-1138	1F-1136	1F-1134	1F-1165-20'	1F-1146-10'
Date Sampled		12/10/98	12/10/98	12/10/98	12/10/98	12/10/98	07/02/99	08/23/99
Depth (feet below ground surface)		3.0	3.0	3.0	3.0	3.0	2.5	3.0
	Unit							
EPA 6010								
Antimony	mg/kg	0.41 U	0.42 U	0.43 U	0.42 U	0.41 U	0.49 U	0.59 U
Arsenic	mg/kg	0.43 J	3.1	3.3	3.9	6.4	1.4	0.73 J
Copper	mg/kg	2.5 U	10.8	26.2	36.8	22.8	6.7	3.8
Iron	mg/kg	3450	16200	17100	19600	15500	30400	6680
Lead	mg/kg	0.80 U	3.0	18.0	27.8	2.0	0.29 U	3.1
Zinc	mg/kg	7.0	13.5	111	66.9	23.6	84.8	16.5

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-1
Summary of Final Perimeter (Wall) Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-666
Location Code		1F-1156-65'
Date Sampled		09/16/99
Depth (feet below ground surface)		2.0
	Unit	
EPA 6010		
Antimony	mg/kg	22 U
Arsenic	mg/kg	2.7
Copper	mg/kg	20.8
Iron	mg/kg	13800
Lead	mg/kg	34.3
Zinc	mg/kg	60.5

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-2
Summary of Final Floor Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-318	19739-321	19739-328	19739-330	19739-334	19739-337	19739-339
Location Code		1F-B4-01	1F-A4-01	1F-D1-02	1F-C1-01	1F-D6-02	1F-C6-02	1F-F1-01
Date Sampled		07/19/99	07/19/99	07/19/99	07/19/99	07/19/99	07/19/99	07/20/99
Depth (feet below ground surface)		3.5	3.5	5.0	3.5	9.0	9.0	5.5
EPA 6010	Unit							
Antimony	mg/kg	0.82 U	3.9 U	0.41 U	3.0 U	0.40 U	0.42 U	0.42 U
Arsenic	mg/kg	1.6 U	0.37 U	3.5 U	1.2 U	1.7 U	1.7 U	2.4
Copper	mg/kg	7.0 U	4.2 U	23.4	6.8 U	5.1	5.1 U	12.4
Iron	mg/kg	7130	8210	28200	11500	21300	7090	20400
Lead	mg/kg	12.5	6.9	6.8	3.3	5.1	13.3	9.9
Zinc	mg/kg	31.0	27.6	88.2	17.2	65.4	35.5	103

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-2
Summary of Final Floor Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-342	19739-343	19739-379	19739-382	19739-388	19739-389 (Dup)	19739-392
Location Code		1F-G2-02	1F-H2-01	1F-G5-02	1F-F2-02	1F-H6-02	1F-H6-02	1F-I7-02
Date Sampled		07/20/99	07/20/99	07/21/99	07/21/99	07/22/99	07/22/99	07/22/99
Depth (feet below ground surface)		7.0	5.5	9.0	7.0	7.5	7.5	9.0
EPA 6010	Unit							
Antimony	mg/kg	0.45 U	0.38 U	0.46 U	0.57 U	0.36 U	0.36 U	0.27 U
Arsenic	mg/kg	4.3	3.5	4.5	3.8	4.3	4.9	2.5
Copper	mg/kg	49.7	26.1	9.6	41.0	29.3	27.5	14.0
Iron	mg/kg	36100	18400	14400	31600	20700	18700	11800
Lead	mg/kg	7.3	2.3	2.2 U	10.0	1.9	1.9	1.2 J
Zinc	mg/kg	101	39.0	13.5	94.3	32.3	29.1	18.4

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-2
Summary of Final Floor Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-393	19739-396	19739-399	19739-402	19739-405	19739-406	19739-407
Location Code		1F-I5-01	1F-E1-01	1F-I6-01	1F-F3-02	1F-H5-02	1F-C2-01	1F-E6-01
Date Sampled		07/22/99	07/22/99	07/22/99	07/22/99	07/22/99	07/22/99	07/22/99
Depth (feet below ground surface)		5.5	5.5	7.5	7.0	9.0	3.5	7.5
EPA 6010	**Unit**							
Antimony	mg/kg	0.35 U	0.73	0.36 U	0.58 U	0.49 U	0.37 U	0.45 U
Arsenic	mg/kg	4.4	3.7	4.2	5.6	6.9	0.61 J	2.9
Copper	mg/kg	23.9	35.6	19.7	38.2	32.7	2.7	7.7
Iron	mg/kg	22300	27600	19100	29400	23700	16400	19000
Lead	mg/kg	2.0	9.3	1.2 U	12.0	2.8	2.7	5.4
Zinc	mg/kg	27.3	85.1	22.0	120	27.1	50.4	38.6

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-2
Summary of Final Floor Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-449	19739-450 (Dup)	19739-452	19739-454	19739-456	19739-458	19739-460
Location Code		1F-C4-02	1F-C4-02	1F-C3-02	1F-D4-02	1F-E3-02	1F-D3-02	1F-D2-02
Date Sampled		08/02/99	08/02/99	08/02/99	08/02/99	08/02/99	08/02/99	08/02/99
Depth (feet below ground surface)		13.2	6.2	9.6	12.6	13.4	11.5	6.7
EPA 6010	Unit							
Antimony	mg/kg	0.39 U	0.39 U	0.59 U	0.37 U	0.48 U	0.43 U	0.39 U
Arsenic	mg/kg	0.60 J	0.81 J	3.1	1.1 J	2.0	2.0	2.6
Copper	mg/kg	7.9	3.0	12.8	7.9	25.4	17.3	24.5
Iron	mg/kg	4730	6820	16000	7260	19200	14500	16900
Lead	mg/kg	6.3	4.1	7.9	3.3	8.1	10.3	5.4
Zinc	mg/kg	31.4	16.5	22.1	14.3	79.7	59.1	52.2

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-2
Summary of Final Floor Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-499	19739-501	19739-503	19739-505	19739-508	19739-511	19739-513
Location Code		1F-F5-03	1F-E5-03	1F-D5-02	1F-C5-01	1F-B3-03	1F-E4-02	1F-H3-03
Date Sampled		08/12/99	08/12/99	08/12/99	08/12/99	08/12/99	08/12/99	08/12/99
Depth (feet below ground surface)		9.3	15.9	9.2	7.5	6.2	11.9	10.5
	Unit							
EPA 6010								
Antimony	mg/kg	0.38 U	0.29 U	0.30 U	0.32 U	1.7	0.31 U	0.34 U
Arsenic	mg/kg	5.2	0.23 U	4.3	2.1	1.3	4.0	4.0
Copper	mg/kg	44.3	7.1	21.6	15.2	27.9	7.2	44.1
Iron	mg/kg	20100	6280	24900	17000	8290	22900	27000
Lead	mg/kg	8.8	2.4	12.9	15.3	29.8	5.8	3.3
Zinc	mg/kg	52.7	12.5	71.9	142	146	25.7	50.3

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-2
Summary of Final Floor Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-517	19739-532	19739-535	19739-538	19739-541	19739-543	19739-572
Location Code		1F-F4-02	1F-I2-03	1F-I3-03	1F-I4-03	1F-H4-04	1F-E2-03	1F-G4-03
Date Sampled		08/12/99	08/16/99	08/16/99	08/16/99	08/16/99	08/16/99	08/23/99
Depth (feet below ground surface)		7.6	9.4	9.4	9.0	11.9	8.4	8.0
	Unit							
EPA 6010								
Antimony	mg/kg	0.34 U	1.2 U	0.81 U	0.78	0.65 U	0.64 U	0.75 U
Arsenic	mg/kg	4.0	1.6	2.0	4.8	5.3	3.7	9.4
Copper	mg/kg	50.2	24.7	19.9	33.9	25.5	14.9	38.0
Iron	mg/kg	31900	18800	10800	18200	19800	21200	29300
Lead	mg/kg	8.8	3.9	2.7	1.9	0.84 J	3.3	8.2
Zinc	mg/kg	93.2	46.5	38.6	49.8	28.1	26.7	77.3

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

Table E-2
Summary of Final Floor Confirmation Sampling Results — IR Site 1F, Camp Pendleton

Sample Identification		19739-667
Location Code		1F-G3-05
Date Sampled		09/16/99
Depth (feet below ground surface)		14.8
	Unit	
EPA 6010		
Antimony	mg/kg	26 U
Arsenic	mg/kg	2.9
Copper	mg/kg	9.7
Iron	mg/kg	15800
Lead	mg/kg	4.9
Zinc	mg/kg	40.7

EPA - US Environmental Protection Agency
J - estimated value
mg/kg - milligrams per kilogram
U - not detected at or above the stated reporting limit
Dup - duplicate sample collected in field

APPENDIX F
REVIEW COMMENTS

California Regional Water Quality Control Board
San Diego Region

W[illegible]on H. Hickox
retary for
...vironmental
Protection

Internet Address: http://www swrcb ca gov/rwqcb9/
9174 Sky Park Court, Suite 100, San Diego, California 92123
Phone (858) 467-2952 • FAX (858) 571-6972

Gray Davis
Governor

October 10, 2002

Department of the Navy
Southwest Division Naval Facilities Engineering Command (SWDIV)
Attn: Mr. Michael Bilodeau
1220 Pacific Highway
San Diego, California 92132-5190

File No. 30-0456.05

Dear Mr. Bilodeau:

SUBJECT: DRAFT REMEDIAL ACTION SITE CLOSURE REPORT, OPERABLE UNIT 3, INSTALLATION RESTORATION SITE 1F, 43 AREA REFUSE BURNING GROUND, MARINE CORPS BASE, CAMP PENDLETON, CALIFORNIA

The Regional Water Quality Control (San Diego, RWQCB) has reviewed the above referenced document (Report) prepared by IT Corporation, and dated August 16, 2002. The Report presents an overview of site investigation, remedial, and restoration activities conducted at Installation Restoration (IR) Site 1F to eliminate conditions that pose a threat to human health and the environment. Remedial activities at IR Site 1F were conducted June 28, 1999 through September 20, 1999, and restoration and revegetation activities were conducted July 12, 2000 through October 2000.

The Report is a well-written, formatted, and organized document that contains all the pertinent information necessary for review. Based on current site conditions, the consultant concludes and recommends the following:

- Site 1F has been remediated in accordance with the OU 3 ROD,
- Site 1F conditions no longer pose a threat to human health or the environment, and
- long term postclosure operation, monitoring, or maintenance is not required at Site 1F.

Based on the Report, it appears that the consultant's conclusions and recommendation are correct and appropriate. Additionally, based on the quality of the document, the generation and submittal of a draft final version of the Report does not seem to be warranted.

If you have any questions regarding this letter, I may be reached by phone at (858) 467-2728 or by electronic mail at grifb@rb9.swrcb.ca.gov.

Sincerely,

Beatrice Griffey

Beatrice Griffey, M.Sc., RG
Associate Engineering Geologist
Site Mitigation and Cleanup Unit

BG;jpa;bg C:\Facilities\Camp Pendleton\CERCLA Prgrm\Various Reports\Closure Reports\Site 1F.doc

Cc:
U.S. Environmental Protection Agency, Region 9
Attn: Mr. Martin Hausladen
75 Hawthorne St.
San Francisco, CA 94105-3901

Department of Toxic Substances Control
Attn; Mr. Tayseer Mahmoud
5796 Corporate Ave.
Cypress, CA 90630

Office of the Chief of Staff - Environmental Security
Engineering Department
Attn: Ms. La Rae Landers
P.O. Box 555008, U.S. Marine Corps Base
Camp Pendleton, CA 92055-5008

IT Corporation
Attn: Mr. Max Pan
3347 Michelson Drive, Suite 200
Irvine, CA 92612-1692

Department of Toxic Substances Control

Edwin F. Lowry, Director
5796 Corporate Avenue
Cypress, California 90630

Winston H. Hickox
Agency Secretary
California Environmental
Protection Agency

Gray Davis
Governor

October 16, 2002

Mr. Mike Bilodeau
Southwest Division Naval Facilities
Engineering Command
1220 Pacific Highway, (Code 532. MB)
San Diego, California 92132-5190

APPROVAL OF DRAFT REMEDIAL ACTION SITE CLOSURE REPORT FOR SITE 1F, OPERABLE UNIT 3, MARINE CORPS BASE CAMP PENDLETON

Dear Mr. Bilodeau:

The Department of Toxic Substances Control (DTSC) has reviewed the above subject document dated August 16, 2002, prepared by IT Corporation. The report documents the remedial action activities, site backfilling and restoration activities, and confirmation sampling conducted at Installation Restoration (IR) Site 1F, 43 Area Refuse Burning Ground, at Marine Corps Base Camp Pendleton. The volume of burn debris and contaminated soil removed from the site was approximately 55,250 cubic yards and was transported to and disposed of at the Corrective Action Management Unit located at IR Site 7, Box Canyon Landfill.

Based on the results of the confirmation sampling, the remedial action met the remediation standards specified in the Operable Unit 3 Record of Decision. DTSC agrees with the conclusions and recommendation of the report and we hereby approve it. The site is now considered closed and no long term operation, monitoring, or maintenance is needed

We look forward to working with you to expedite the investigation and cleanup of the sites. If you have any questions, please call Mr. Tayseer Mahmoud, Remedial Project Manager, at (714) 484-5419.

Sincerely,

Emad Yemut

Emad B. Yemut, P.E., Unit Chief
Office of Military Facilities
Southern California Operations

cc: Ms. Beatrice Griffey
Project Manager
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, California 92123-4340

Mr. Martin Hausladen
Remedial Project Manager
U.S. Environmental Protection Agency, Region IX
441 Denton Way
Santa Rosa, California 95401-4728

Ms. La Rae Landers
Office of Chief of Staff - Environmental Security
P.O. Box 555008
U.S. Marine Corps Base
Camp Pendleton, California 92055-5008

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

July 17, 2003

Mr. Mike Bilodeau
Project Manager
Southwest Division Naval Facilities
Engineering Command
1220 Pacific Highway,(Code 532.MB)
San Diego, CA 92132-5190

APPROVAL OF REMEDIAL ACTION SITE CLOSURE REPORT SITE 1F, MARINE CORP BASE CAMP PENDLETON, CALIFORNIA

Dear Mr. Bilodeau:

The United States Environmental Protection Agency(USEPA) has reviewed the above referenced document and finds our comments have been addressed and we therefore have no further comments.

We wish to thank the Marine Corps for the opportunity to participate in this project and look forward to continued success in the environmental remediation projects at the Camp. If you have questions regarding this letter feel free to contact me at (415) 972-3007.

Sincerely,

Martin Hausladen
Project Manager

cc:
Department of Toxic Substances Control
Attn: Mr. Tayseer Mahmoud
5796 Corporate Ave.
Cypress, CA 90630

California Regional Water Quality Control Board
San Diego Region
Attn: Ms. Beatrice Griffey
9174 Sky Park Court, Suite 100
San Diego, Ca 92123-4340

Office of the Chief of Staff - Envirnomental Security
Engineering Department
Attn: Ms. La Rae Landers
P.O. Box 555008, U.S. Marine Corps Base
Camp Pendleton, CA 92055-5008